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Obstetrics and Gynaecology
of the British Empire

EDITOR
JAMES YOUNG

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BRITISH CONGRESS OF OBSTETRICS & GYNAECOLOGY

LEEDS: 8th—11th JULY, 1952

VOL. LIX OCTOBER 1952 NO. 5

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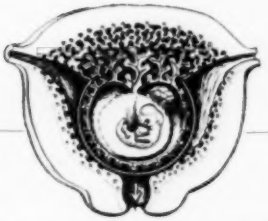

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1. Am.J.Obst. & Gynec. 55:511, 1948.
2. Am.J.Obst. & Gynec. 58:176, 1949.

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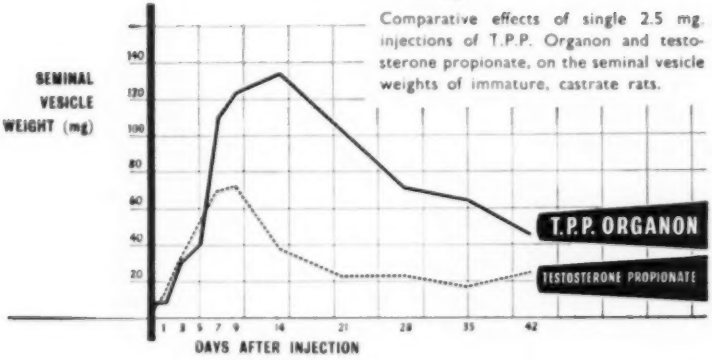

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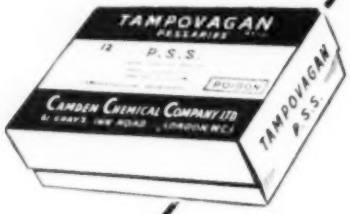
[1] O'Sullivan, *The Practitioner*, No. 986, August 1950



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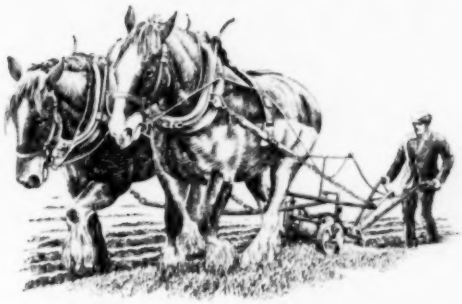

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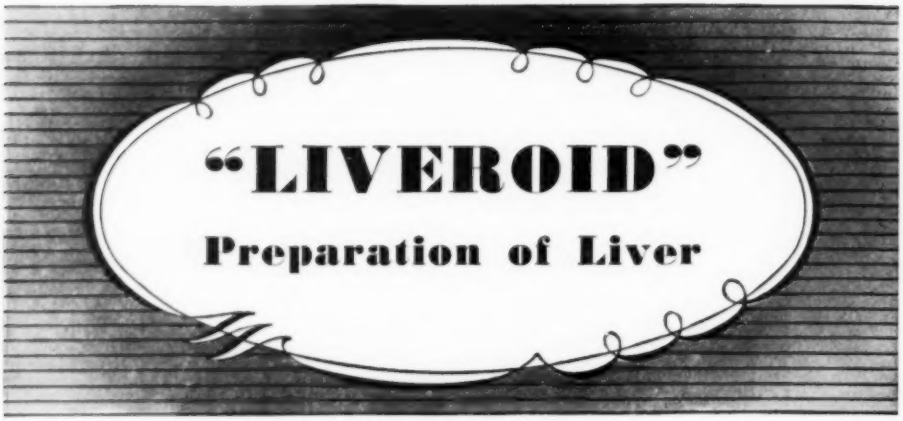

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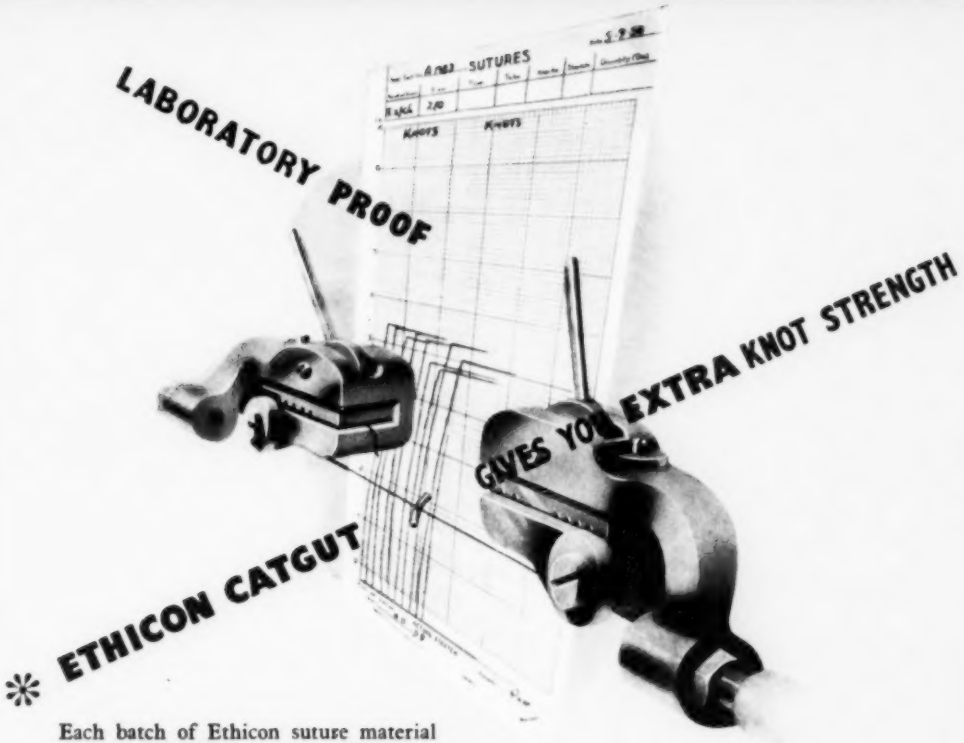

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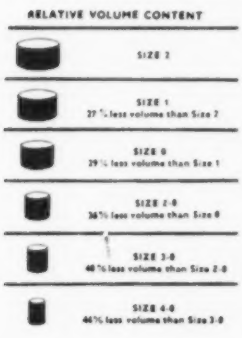
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SECTION X

CONTENTS

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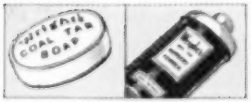

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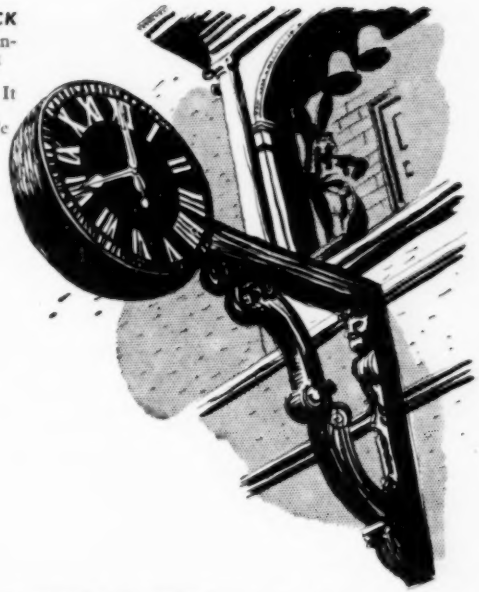

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When comparable figures are given either the English or the metric mode must be followed, thus: the excretion of urine/24 hours should be shown in ml. (and not ounces) when the urinary or blood-urea is given in g./100 ml.

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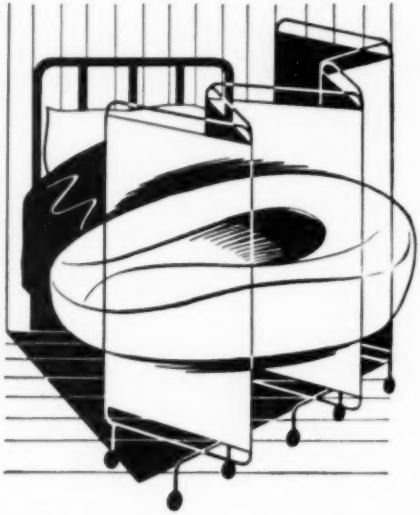

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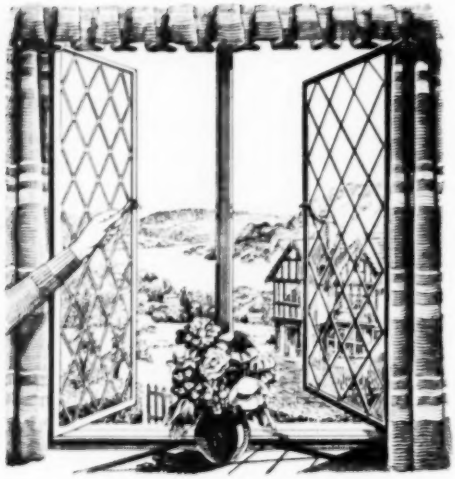

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Proceedings of the Thirteenth BRITISH CONGRESS OF OBSTETRICS & GYNAECOLOGY

LEEDS: 8th—11th JULY, 1952

Tuesday, 8th July: Morning Session

CHAIRMAN:

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President of the Congress

Opening Address by DAME HILDA LLOYD, D.Sc., F.R.C.S.
President of the Royal College of Obstetricians and Gynaecologists

The Guest Paper, **"Carcinoma of the Body of the Uterus,"** by

PROFESSOR M. A. VAN BOUWDIJK BASTIAANSE
Director of the Department of Obstetrics and Gynaecology in the University of Amsterdam

ABNORMAL UTERINE ACTION DURING LABOUR

OPENING SPEAKERS:

PROFESSOR G. H. BELL, M.D., F.R.F.P.S., F.R.S.(Ed.)
Professor of Physiology, University College, Dundee

PROFESSOR W. C. W. NIXON, M.D., F.R.C.S., F.R.C.O.G.
Director of Obstetric Unit, University College Hospital Medical School, London

Afternoon Session

CHAIRMAN:

PROFESSOR J. CHASSAR MOIR, M.D., F.R.C.S., F.R.C.O.G.
President of the Midland Obstetrical and Gynaecological Society

ABNORMAL UTERINE ACTION DURING LABOUR (*continued*)

Wednesday, 9th July: Morning Session

CHAIRMAN:

MR. PERCY MALPAS, F.R.C.S., F.R.C.O.G.
President of the North of England Obstetrical and Gynaecological Society

THE PLACE OF THE PAEDIATRICIAN IN A MATERNITY UNIT

OPENING SPEAKERS:

PROFESSOR WILFRID GAISFORD, M.D., M.Sc., F.R.C.P.
Professor of Child Health and Paediatrics, University of Manchester

MR. FRANCIS E. STABLER, M.D., F.R.C.S., F.R.C.O.G.
Princess Mary Maternity Hospital, Newcastle upon Tyne

Thursday, 10th July: Morning Session

CHAIRMAN:

PROFESSOR GILBERT I. STRACHAN, F.R.C.P., F.R.C.S., F.R.C.O.G.
President of the Obstetric Section of the Royal Society of Medicine

STRESS INCONTINENCE OF URINE

OPENING SPEAKERS:

DR. ALBERT H. ALDRIDGE
Chief Surgeon, Woman's Hospital, in the State of New York, U.S.A.

PROFESSOR T. N. A. JEFFCOATE, M.D., F.R.C.S., F.R.C.O.G.
Professor of Obstetrics and Gynaecology, The University, Liverpool

Afternoon Session

CHAIRMAN:

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STRESS INCONTINENCE OF URINE (*continued*)

Friday, 11th July: Morning Session

CHAIRMAN:

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GENITAL TUBERCULOSIS IN THE FEMALE

OPENING SPEAKERS:

DR. R. MAGNUS HAINES, M.D.
Director of Pathology, Chelsea Hospital for Women, London

MR. JOHN STALLWORTHY, M.A., F.R.C.S., F.R.C.O.G.
Director, Area Department of Obstetrics and Gynaecology, United Hospitals, Oxford

THE GUEST PAPER

CANCER OF THE BODY OF THE UTERUS

BY

M. A. VAN BOUWDIJK BASTIAANSE

Director of the Department of Obstetrics and Gynaecology in the University of Amsterdam

I HAVE chosen cancer of the body of the uterus as the subject of my address because the method of treatment used in my clinic for this condition, as also for cancer of the cervix, varies greatly from that in general use.

The frequency of carcinoma of the uterus in the Netherlands is not precisely known since only the deaths due to this condition are communicated to the Central Bureau of Statistics.

The death rate due to carcinoma in general is gradually rising, as in all other countries. Carcinoma of the uterus, on the other hand, is not increasing and even shows a slight tendency to decrease. The average death rate from carcinoma of the uterus was 13.56 per 100,000 women in the period 1936 to 1939 inclusive, while from 1947 to, and including, 1949 the figure was 13.27. This decrease was noted both for cancer of the cervix as well as for the body of the uterus. I have not included the figures for the war years as the statistics for this period are not trustworthy.

The mortality in women above 40 years of age per 100,000 living women in this age group was as follows:

TABLE I

Carcinoma

Year	Of the corpus	Of the cervix
1936	11.9	21.3
1949	10.9	20.2

The figures do not include all cases of carcinoma of the uterus, since true localization was not always possible. The cases in which localization was found impossible were classified to a third group. According to the Central Bureau of Statistics the percentage in this third group in both periods remained approximately the same, so that the above differences cannot be attributed to more accurate diagnosis.

From 15th August, 1938, to the end of 1951, 264 patients with carcinoma of the body of the uterus were admitted to the Women's Clinic of the University of Amsterdam, as compared with 787 with carcinoma of the cervix, a ratio of 1:2.8. In the death statistics for the Netherlands the ratio is 1:1.7. The explanation for this discrepancy may be that the results from the treatment of carcinoma of the corpus are much better than for carcinoma of the cervix. This ratio is in approximate agreement with those in recent publications from other clinics.

We have observed the following complications in our patients:

Marked obesity: 55 cases. The reducing effect of our wartime diet is unfortunately a thing of the past.

Diabetes: 19 cases. The diagnosis was made on examination of the urine; the blood was not routinely examined in the earlier period.

Hypertension: 169 cases. The systolic blood-pressure exceeded 150 mm.Hg in 169 cases, and 200 mm.Hg in 33 cases. The highest blood-pressure was 270/170 mm.Hg. Forty-six women, or 17.4 per cent, had never been pregnant.

One hundred and thirty-six, or 51 per cent, continued to menstruate until after they were 52 years of age. The onset of the menarche showed no deviation from the general average.

The Association between Functional Uterine Bleeding and Carcinoma

Previous functional bleeding had occurred in only 7 cases. The cancer developed in 5 of these women after, and in 2 before, the menopause.

There are strong indications that oestrogenic substances may be of great importance in the aetiology of uterine cancer. The frequent occurrence of a late menopause and the association of hyperplasia with a carcinoma of the corpus, or the transformation of the latter from the former, may be held to support this view (Ingram and Novak, 1951).

Stanley Way (1951) stated that women with a carcinoma of the body frequently give a history of functional bleeding during the period of sexual maturity. Such has not been our experience. We did, however, find hyperplasia together with carcinoma in the same slide in no fewer than 21 cases. Three of these women had not yet reached the menopause. The oldest patient in whom a hyperplasia and a carcinoma were associated was 75 years of age. Transformation from hyperplasia into carcinoma must be especially looked for in cases giving a history of prolonged functional bleeding and we have seen this to occur on several occasions. A typical example is that of a woman of 38 years who had had functional bleeding for 10 years. Repeated curettage had always revealed hyperplasia, sometimes associated with a marked metaplasia. Finally, at the age of 38 years a carcinoma developed (Figs. 1, 2, 3, 4).

Transformation into carcinoma particularly occurs with atypical hyerplasia. An example of this is shown in sections from a patient 57 years of age (Figs. 5, 6, 7, 8, 9, 10). Figs. 5, 6, 7, 8, show sections of endometrium obtained by curettage on 12th October, 1948. A curettage on 28th March, 1949, gave similar pictures and no evidence of malignancy was seen. Since the vaginal smears continued to show Papanicolaou III, vaginal hysterectomy was performed on 23rd July, 1949. Histological investigation of the uterus revealed an adenocarcinoma, and this case demonstrates the importance of examining vaginal smears.

It is well known that metaplastic stratified endometrium but rarely changes into a carcinoma. An adenocarcinoma with an area of metaplasia (adeno-acanthoma) is not so very rare. Sections obtained from a patient 40 years of age demonstrate this change (Figs. 11, 12). Malignant changes occurring in metaplastic stratified epithelium removed from a patient of 65 years is shown in Figs. 13 and 14. A combination of carcinoma of the body with a granulosa cell tumour, of which several cases are cited in the literature, has not occurred in our series.

The age distribution of carcinoma of the body in our clinic is shown in Table II.

Table II

	Age	No. of cases
Up to and including:	40 years	9
	41–50 years	37
	51–60 years	117
	61–70 years	64
	71–80 years	34
Above	80 years	3

The youngest patient was 33 and the oldest 84 years old. Of the 264 patients, 39, or almost 15 per cent, had not reached the menopause.

Diagnosis

The vaginal smear frequently arouses the first suspicion of early carcinoma, but a positive diagnosis is only made on the histological examination of the endometrium removed by curettage.

From the prophylactic standpoint we, like many others, are extremely careful with the administration of oestrogenic preparations to women in whose families cancer has occurred. In the treatment of women with functional bleeding, especially those above the age of 50 years, an increased risk of cancer must be considered. This, as well as the disadvantage of withdrawal symptoms, has caused Röntgen castration to be used less and less frequently in such cases. When hormonal therapy is not successful, hysterectomy, usually by the vaginal route, is preferred. The literature reveals that more and more gynaecologists prefer hysterectomy (usually by the abdominal route) to Röntgen castration (Way, 1951).

The incidence of vaginal hysterectomy for functional bleeding and the age at which the operation was performed, is shown in Table III.

TABLE III

Age	No. of cases
Under 50 years	57
Over 50 years	25

There has been no primary mortality from the operation. Two patients had a thrombosis and one a pelvoperitonitis.

TREATMENT

With regard to the treatment of carcinoma of the body of the uterus there is practically universal agreement that operative treatment is preferable to radium therapy. Heyman (1947), and in his wake several other radiologists, believe that radium therapy by the packing technique gives just as good results as does surgery, on the proviso that any recurrence is treated by hysterectomy. It has been frequently reported (Corscaden, 1951) that living cancer cells have been found in a number of cases after the packing technique. Corscaden concludes from the literature that even after the most efficient radium therapy living cancer cells remain in about 30 per cent of the cases. Heyman (1947) attempts to overcome this disadvantage by performing hysterectomy should recurrence of the growth occur.

Other gynaecologists give a pre-operative course of radium. The chief argument for pre-operative radiological treatment is that the superficial cancer cells are destroyed and the possibility of implantation of cancer cells in the wound is thereby reduced or removed. There is certainly much to be said for this argument. Even though the cervical canal is carefully closed with sutures before the operation, the possibility of cancerous material oozing between the sutures is always present. The chance of implantation must be much less after a vaginal operation than following an abdominal hysterectomy. In the last phase of the latter operation the vagina is cut through and extruded cancer cells can then easily drop into the wound. Suture of the cervical canal will not always prevent the extrusion of these cells. With the vaginal operation the cervix is brought further and further to the outside, and one can also see directly when secretion escapes from the cervical canal. The follow-up of 217 vaginal hysterectomies in our clinic revealed one recurrence in the vault of the vagina in a patient operated upon in 1948. Following 33 abdominal hysterectomies a recurrence in the vault of the vagina was discovered in 3 cases, 2 being operated on in 1947 and 1 in 1949. For various reasons (one ankylosis, twice negligence on the part of the operator), the cervical canal was not closed in these 3 patients.

The possible disadvantages of pre-operative radium treatment are usually not considered. These do, however, exist and consist of:

(1) The time for operation is postponed, during which period the carcinoma may spread or metastasize.

(2) Infection may occur as the result of the introduction of radium, thereby increasing the operative risk or even making operation impossible.

(3) The manipulations associated with the introduction of radium may free cancer cells into the lymph vessels.

(4) If the bleeding stops the patient may decide to refuse further treatment.

VAGINAL HYSTERECTOMY

With these facts in mind we find that, in so far as vaginal hysterectomy is concerned, the disadvantages of pre-operative radium treatment outweigh the advantages.

Although vaginal hysterectomy is increasingly recommended in the literature there are but few who support its use in the treatment of carcinoma (Kennedy and Campbell, 1942).

The primary mortality is still mentioned as one of the disadvantages of operative treatment, especially since so many elderly women are present in the group with cancer of the body of the uterus. The sharp decrease in operative mortality in the last few years has robbed this argument of much of its strength. It is certainly not true for the vaginal operation, since the primary mortality is probably lower than that with radium treatment.

The Importance of Removal of the Adnexa

A disadvantage often stated against the vaginal operation is that it is not always possible to remove the adnexa. Complete removal of the adnexa is indeed more certain with abdominal hysterectomy. However, unless the patient is a very poor risk, it is usually possible to extirpate both adnexa by the vaginal route, if necessary with the assistance of a uni- or bilateral episiotomy. It is generally accepted that the adnexa must be removed, if possible, but it has not been established that the importance of their removal is as great as some would have us believe. It has been stated in many publications that the incidence of metastasis in the ovary is not large. Novak (1947) reported an incidence of 5 in 147 cases. We observed metastases in the ovaries in 14 out of 204 hysterectomies in which both ovaries were extirpated, i.e. in 7 per cent. In 11 cases, where only one ovary was removed, no metastases were discovered. It is naturally true that, if metastases are present in the ovaries, there is a great possibility that they have also spread to other parts of the body. That this is not necessarily so is shown by the fact that of the 5 women operated upon between 1938 and the end of 1946, in whom metastases were found in one or both ovaries, 2 were still healthy after 5 years. Cancer was present in 4 of these in both, and in the other in one ovary. If we assume that metastases are present in the ovaries in 7 per cent of the cases of cancer of the body, and that 40 per cent of these cases remain healthy after extirpation of the ovaries, then the percentage of 5-year cures with removal of the ovaries would be slightly less than 3 per cent higher than in cases in which they had been left behind.

Table IV gives our results for operation with and without extirpation of the adnexa.

Table IV

	No. of cases	Alive after 5 years
Bilateral appendage removal	81	61 = 75.3 per cent
Unilateral appendage removal	6	3 = 50.0 per cent
Neither ovary removed	27	19 = 70.0 per cent

The 5-year survival rate after extirpation of both ovaries is thus better than after removal of one or neither ovary. Some of the reasons for leaving them behind were extreme old age, marked obesity, or very poor general health, so that the danger of prolonging the operation exceeded that from cancer in the ovaries. Many of these patients would, moreover, have been declared inoperable by the abdominal route.

The Results of Vaginal Hysterectomy

From 15th August, 1938, to 1st January, 1952, 264 patients were admitted to the University Women's Clinic with carcinoma of the body of the uterus. One patient was admitted for acute peritonitis following rupture of a pyosalpinx. At autopsy a corpus-carcinoma was also discovered. This patient is not included in the series. Twelve cases were inoperable, giving an operability rate of 96.2 per cent. Two of the operable patients, the one 72 and the other 82 years old, refused any treatment. With the exception of a woman 84 years of age in extremely poor health, all operable patients underwent operation. The oldest of these was 84 years of age. This shows that the clinically inoperable group, which is so prominent in many statistics (Heyman *et al.*, 1941), is almost non-existent. I doubt if this group would be as small for those who perform the abdominal operation. One often reads in the literature that women over 70 years of age, women with obesity, those in poor general health, etc., should not be subjected to operation. When one is convinced that better results are obtained with operation, this reveals the great disadvantage of abdominal hysterectomy.

Vaginal hysterectomy was carried out in 217 of our patients. Abdominal hysterectomy was performed on 33 occasions, usually because the uterus was too large to be removed vaginally.

Not one patient died as a result of the vaginal operation. In the last year of the war 2 women of 80 and 79 years respectively died, the one 66 and the other 70 days after operation, from a very severe diarrhoea following postoperative X-ray radiation. Severe diarrhoea following X-ray radiation was often seen during the war, so that during the latter years of the war and for a time thereafter older women, or women in

poor general health, were not subjected to this treatment.

Of the 33 women operated upon by the abdominal route, 1 died from an embolus. Another woman of 57 years had very severe heart disease, and died of heart-failure in the medical clinic, 2 months after operation.

Cancer of the Body of the Uterus

Vaginal hysterectomy. Primary mortality 0 in 217 cases.

Abdominal hysterectomy. Primary mortality 1 in 33 cases.

Table V
Cancer of the body of the uterus
15th August, 1938, to 1st January, 1947
5-year cure

Treatment	No. of cases
Vaginal hysterectomy	115
5-year cure	83=72.2 per cent
Abdominal hysterectomy	24
5-year cure	14=58.3 per cent
5-year cure of all operated patients	97=70.0 per cent
Absolute 5-year cures	97 of 145=66.9 per cent

Table VI
Cancer of the body of the uterus
1st August, 1938, to 1st January, 1942
10-year cure rate

Treatment	No. of cases
Vaginal hysterectomy	47
10-year cure	33=70.2 per cent
Abdominal hysterectomy	14
10-year cure	8=57.1 per cent
10-year cure of all operated patients	67.1 per cent
Absolute 10-year cure	41 of 63=65.1 per cent

One Jewish patient, who was transported to Germany during the war and concerning whom no information is available, is not included.

When we consider that so many of our patients had reached an advanced age at the time of treatment, that some had serious incidental diseases, that at least part of the 5-year period of those operated on fell during the war years with its increased mortality due to malnutrition, it is obvious that some of the deaths were not due to the cancer. That the number of deaths increased markedly with advanced age is shown in Tables VII, VIII, IX, X.

Table VII
Vaginal Hysterectomy
1938 to 1947
5-year results

Age at operation:	Up to 41 years	41 to 50 years	51 to 60 years	61 to 70 years	71 to 80 years
Alive without recurrence	2	20	34	22	5
Dead	1	0	13	8	10

Total number alive: 83 out of 115=72.2 per cent.

Table VIII
Vaginal Hysterectomy
1938 to 1942
10-year results

Age at operation:	Up to 41 years	41 to 50 years	51 to 60 years	61 to 70 years	71 to 80 years
Alive	0	11	15	6	1
Dead	0	0	6	7	1

Total number alive: 33 out of 47=70.2 per cent.

TABLE IX
Abdominal Hysterectomy
1938 to 1947
5-year results

Age at operation:	Up to 41 years	41 to 50 years	51 to 60 years	61 to 70 years	71 to 80 years
Alive	1	5	6	2	0
Dead	0	0	5	4	1

Total number alive: 14 out of 24 = 58.33 per cent.

TABLE X
Abdominal Hysterectomy
1938 to 1942
10-year results

Age at operation:	Up to 41 years	41 to 50 years	51 to 60 years	61 to 70 years	71 to 80 years
Alive	1	3	3	1	0
Dead	0	0	4	1	1

Total number alive: 8 out of 14 = 57.1 per cent.

The influence of age is still clearer when the vaginal and abdominal operations are considered together in one group below and the other above 50 years of age (Tables XI and XII).

TABLE XI
Hysterectomy, both Vaginal and Abdominal
5-year cure

	Under 50 years	Over 50 years
Number of cures	29	110
Number healthy after 5 years	28 = ±97 per cent	69 = ±63 per cent

TABLE XII
Hysterectomy, both Vaginal and Abdominal
10-year cure

	Under 50 years	Over 50 years
Total number of cures	15	46
Number healthy after 5 years	15 = 100 per cent	26 = 56.6 per cent

The Netherlands vital statistics, studied for the period 1942 until the end of 1944, revealed that 98 per cent of Dutch women belonging to the 45-year age group are likely to remain alive for 5 years and 95 per cent for 10 years, whereas in the 65-year age group the corresponding figures would be 81 and 69 per cent respectively.

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FIG. 1
Curettage 4th May, 1944. Hyperplasia.

FIG. 2
Curettage 8th November, 1945. Adenomatous hyperplasia.

FIG. 3

Same specimen as Fig. 2. High magnification. Pseudo-stratification and stratification of the glandular epithelium. No malignancy.

FIG. 4

Curettage 21st November, 1949.
Adenocarcinoma endometrii. Invasion of musculature.

FIG. 5
Curettage 12th October, 1948.
Atypical hyperplasia.

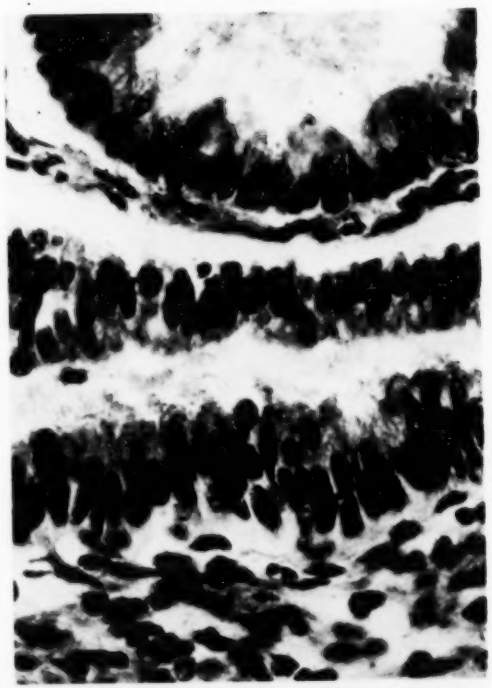

FIG. 6
High magnification of section shown in Fig. 5.

FIG. 7

Another area of section shown in Fig. 5. It shows greater irregularity of the epithelium and mitoses.

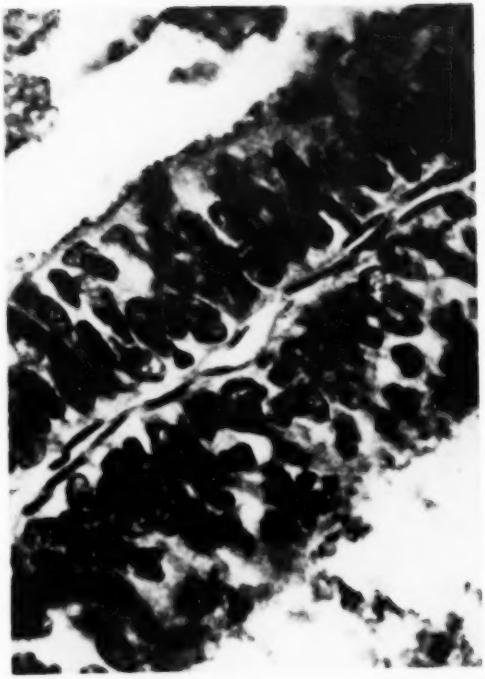

FIG. 8

Still another area from section shown in Fig. 5. Still greater irregularity and stratification.

FIG. 9

Superficial part of the tumour shown in preceding figures (surgical specimen).

FIG. 10

Deeper part of the same tumour (surgical specimen). Invasion of the myometrium.

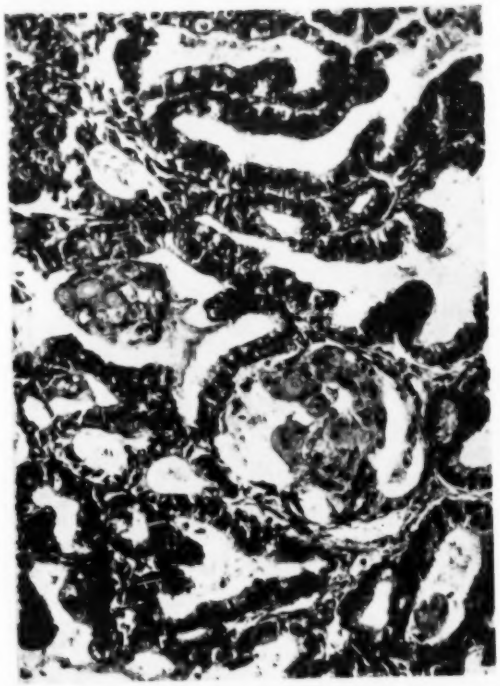

FIG. 11

Adeno-acanthoma corporis uteri.

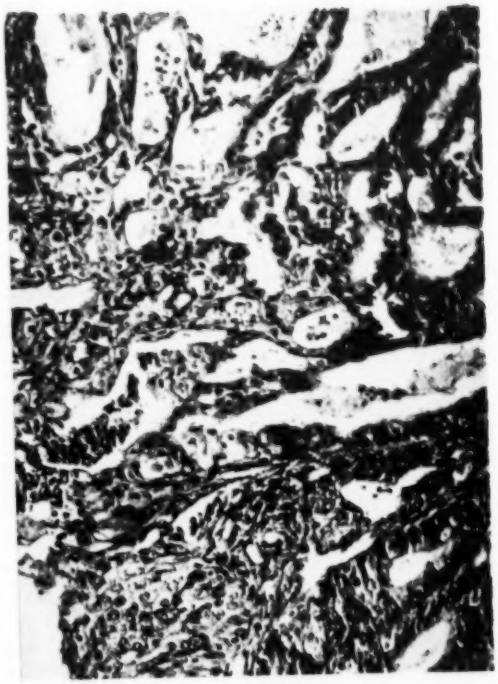

FIG. 12

Metastasis in ovary showing a histological picture similar to that depicted in Fig. 11.

FIG. 13

Adenocarcinoma with malignant stratified epithelium of the body of the uterus.

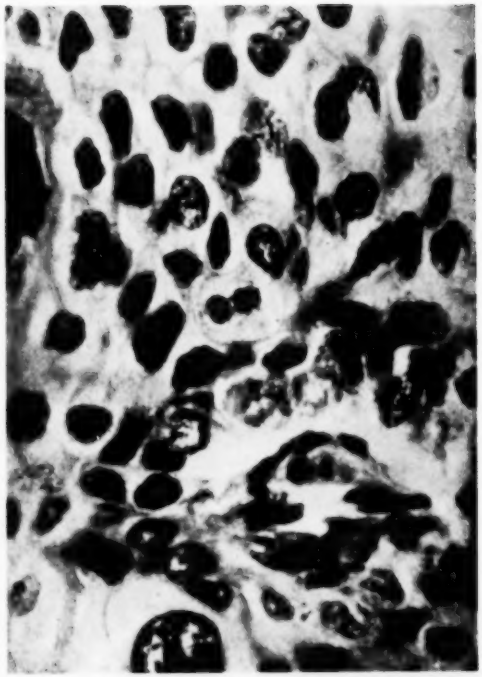

FIG. 14

The stratified epithelium of Fig. 13 under higher magnification.

In view of the rising costs of production and the fact that the annual subscription to the Journal has remained unaltered since 1933, the Council of the Royal College of Obstetricians and Gynaecologists has decided with reluctance to increase the annual subscription from 1st January, 1953, to £3 5s. for Great Britain and Northern Ireland, and £3 15s. for the Dominions, Colonies and foreign countries. Single copies 12s. 6d.

ABNORMAL UTERINE ACTION IN LABOUR

OPENING PAPERS

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The reproductive pattern among laboratory mammals shows remarkable variation and none coincides with the human pattern. It seems as though, in the process of evolution, the different species of mammals have modified and adapted the original process handed down to them by their remote ancestors, but in spite of this we can see certain characteristics in the pattern of uterine behaviour which they all have in common. For example, uterine activity is small during pregnancy and becomes vigorous only at parturition when the foetus is expelled. Furthermore, in the few mammals which have been investigated it has been found that the reactivity of the uterine muscle to the posterior lobe hormones increases up to the end of pregnancy. If, however, we go beyond these now trite and obvious generalizations we find an embarrassing amount of species difference. For example, the effects produced by the ovarian hormones, the hormones of the adrenal medulla, or by stimulating the nerves going to the uterus, are quite unpredictable from one species to another. Thus it is that the physiologist, although he may be able to examine his problems more ruthlessly and in greater detail than can the clinician, cannot be of direct assistance in the solution of human obstetrical problems. Nevertheless he hopes that he will, eventually, perhaps by the use of new techniques, or by the investigation of the action of hormones, or of new drugs, be able at best to reach an understanding of the process of parturition, or at least provide methods which will allow the obstetrician to obtain a greater control over the process in man.

Methods of Recording Uterine Movements

Uterine movements have been investigated by obstetricians and physiologists for well over a hundred years, and in the list of investigators occur such famous names as Brown-Séquard (1858), J. Y. Simpson (1871), Milne Murray (1886) who simply observed the uterine activity without actually recording it. Lode (1894) provides a review of the older literature which goes back as far as Haller (1788). Modern methods may be said to have been applied first at the beginning of this century. Kehrer (1907) suspended the excised uterus of various species, including man, in Locke's solution, as Magnus (1904) had done with the intestine. Kehrer described how contraction waves passed as a rule from the ovarian end of the horns to the cervix and only occasionally in the other direction. He said that the two horns might contract simultaneously or independently and that the movements were greatest at heat. He found that the uteri of pregnant animals showed quick contractions and slow relaxations, with long pauses between the contraction waves. This method of investigation is still in use in every pharmacological laboratory. Kehrer also investigated uterine movements *in vivo* by putting the animal in a bath of warm saline; a thread attached to the uterus passed out through the widely opened abdominal cavity to a recording lever. He found substantial agreement between the spontaneous activity recorded *in vitro* and that recorded *in vivo*, and considered that it was much more convenient to study the action of drugs on the uterus *in vitro*. About the same time Cushny (1906) described the movements of the uterus *in situ* and Dale (1906) made pharmacological investigations on the activity of the uterus *in vivo*. Blair Bell and Hick (1909) investigated uterine movements in pithed rabbits by passing a cannula through the cervix to record the change in volume of the saline-filled uterus. Clark, Knaus, and Parkes (1926) made records of peristaltic

waves passing along the uterus of the rat *in vivo* and found that large waves were well conducted down the uterus at oestrus; they also noted large contractions in the pregnant uterus *in situ*. Genell (1939) described pro- and antiperistalsis *in vivo* in the rat at oestrus with a tightly closed cervix; at other times only peristalsis towards the vagina was seen, and the cervix was easily dilated. Rudolf and Ivy (1931) and Danforth, Greene, and Ivy (1937) investigated the co-ordination of the uterine movements in the dog and came to the conclusion that there was an intrinsic regulating mechanism.

I have referred to these historical matters to show that methods for recording the uterine activity in animals were well developed before the time (say 1925) when we first began seriously to think in terms of ovarian and pituitary hormones. Knaus (1927, 1928, 1930a) was the first to carry out systematic work on the behaviour of the uterus of the pregnant rabbit *in vitro* and Robson (1932, 1933a, 1933b) reinvestigated this work in a quantitative fashion. About the same time Reynolds (1930) described the fistula method by which records of the movements of the uterus can be obtained in the unanaesthetized rabbit. The work of Knaus and Robson showed that after mating the uterine movements became much less, but later in pregnancy they became more marked, and reached their greatest extent at parturition. It was only near parturition that the uterus reacted at all to oxytocin. Both Robson and Reynolds showed that the oestrone treatment increased the spontaneous activity. Knaus (1930a, 1930b), and others showed that extracts of corpus luteum injected into rabbits reduced the reactivity of the uterine muscle *in vitro* to pituitrin. The desensitization and quiescence of the uterus in early pregnancy was explained as being due to the corpus luteum hormone and the later increase in spontaneous reactivity was alleged to be produced by oestrone. This idea has received, perhaps unfortunately, general acceptance.

The recording of the activity of the human uterus offers greater difficulties. Schatz (1872) seems to have been the first to use an intra-uterine bag which was connected to a reservoir. The variations in the pressure in the bag caused by the activity of the uterus were recorded on a drum by a float on a mercury manometer and this method has been used by Bourne and Burn (1927), by Knaus (1929, 1934), by Chassar Moir (1934), and others. The intra-uterine pressure has also been recorded by Karlson (1947) by pressure receptors carried on the end of catheters introduced into the uterine cavity in the pregnant or non-pregnant state; the pressure on the membrane in each receptor is recorded by means of a self-registering milliammeter. The first to be sufficiently courageous to record uterine activity by passing a cannula through the anterior abdominal wall and through the uterine wall in the pregnant woman seem to be Alvarez and Caldeyro Barcia (1948, 1950a, 1950b). Williams and Stallworthy (1952) have achieved much the same result by passing a catheter through the cervix and into the amniotic sac. I am not competent to judge the relative risk to the patient of the methods of internal hysterography, but I would hazard a guess that the method devised by Alvarez and Caldeyro Barcia, since it causes the minimum of disturbance, is likely to produce a truer record than any of the other methods available. It cannot provide a picture of the activity of the different parts of the uterus but the amniotic pressure can be expressed in absolute units.

External tokography, or external hysterography, must, of course, have begun subjectively, the contractions of the pregnant uterus being obvious to the examiner's hand placed on the abdominal wall. External hysterography is based on the principle that a weight laid on a muscle is raised when the muscle contracts and sinks back again when the muscle relaxes. Probably the first to describe this method was Rübsamen (1913). Such a simple principle can, of course, be exploited in many different ways. This has been done by Crodel (1930), Frey (1933), Lorand (1933), and Murphy (1947). The most elaborate is that invented by Reynolds, Heard, Bruns, and Hellman (1948), which consists of a strain gauge, the tension in which is recorded by a galvanometer writing on a chart. It is possible also to record changes in the uterine consistency by applying balloons to the abdominal wall which are connected to recording tambours—the uterine polygraph of Alvarez and Caldeyro Barcia (1950b). The great advantage of external hysterography is that it is

possible, without fear of sepsis, to record from different positions of the pregnant uterus but, although it is possible to time the events in the various portions of the uterus, absolute values of internal pressure or of the force of contraction cannot be obtained. In any case it is difficult to record the activity through the abdominal wall of the lowest parts of the uterus, which must play a very important part in the process of parturition.

The electrical activity associated with the contraction of the human uterus in labour has been recorded by Bode (1931) and others. The latest exponents of this type of investigation are Steer and Hertsch (1950), who have correlated the action currents with the uterine activity as recorded by an external strain gauge. The contractions of the uterus are accompanied by electrical waves. This method has the advantage that the electrical activity of various parts of the uterus, and even of the cervix, can be easily studied with almost no disturbance of the patient. While these authors claim, reasonably enough, that it is possible to differentiate normal from abnormal labour, the connexion between the potentials recorded on the abdominal wall and the strength of the uterine contractions must, at the best, be indirect.

With such a plethora of methods at our disposal, it is a great relief to find that simultaneous recordings by three different methods have been made by Caldeyro, Alvarez, and Reynolds (1950). They used the external strain-gauge method developed by Reynolds *et al.* (1948) and the uterine polygraph as described by Caldeyro and Alvarez (1950), together with the direct measurement of the pressure of the amniotic fluid, using the method of Alvarez and Caldeyro (1948). It was found that in normal labour the majority of the contractions are synchronous and that when all the parts of the uterus contract at the same time the amniotic pressure rises to a high value; when all the parts relax simultaneously the amniotic pressure reaches the lowest value. If the contractions are not synchronized then the effect on the amniotic pressure is relatively small. So far as one can judge from the published records there is very little difference between the polygraph and strain gauge records, except in details.

As a result of their combined internal and external observations these authors described the characteristics of normal labour as: (1) strong contractions; (2) strong fundal dominance; (3) good synchronization between the different parts; (4) descent of amniotic pressure between contractions to about 10 mm.Hg. This description of normal uterine action is approximately the same as that given by older workers, but these authors have crystallized it in the striking expression "fundal dominance". In normal labour they claim that there is a decline in the activity of the human uterus from the fundus towards the cervix, but one may be hesitant about the unqualified acceptance of this idea in view of the difficulties of recording the activity of the lower part of the uterus by external hysterography. Karlson (1947, 1949) recorded variations in pressure within different sections of the uterus in labour. The pressure curves in the corpus, the lower uterine segment and the cervix during labour are frequently so parallel that transmission of pressure from one part to another cannot be considered impossible. Often, however, there is a sufficient degree of dissociation to suggest the existence of independent motility within the lower parts of the uterus. This author, contrary to the current belief, is of the opinion that both the corpus and the lower parts of the uterus are active during labour. In the first stage, however, cervical contractions were usually shorter in duration than those from the higher parts of the uterus. Later, simultaneous contractions of the corpus and isthmus produced dilatation of the cervix. Steer and Hertsch (1950) have produced electrical evidence that in labour the cervix shows active contractions. Danforth (1947) has found that the human cervix consists chiefly of fibrous connective tissue with an average, in the pregnant state, of about 10 per cent of smooth muscle. The contractions of the cervical region cannot, therefore, be very powerful. This is in line with the findings of Naeslund, Snellman, Csapo, and Erdös (1948) that during pregnancy the content of the contractile protein actomyosin in uterine musculature rises, but the increase is greatest in the body of the uterus and not in the isthmus. To sum up, the mechanical, electrical, and chemical findings supply evidence for a decrease in gradient of activity from the fundus towards

the cervix. This does not, however, deny the possibility that the muscle in the lower parts of the uterus, although less powerful, has useful and important functions.

Influence of Hormones and Drugs

The recording of the naturally occurring, or so-called spontaneous activity of the uterus is certainly of great importance for the definition or description of the normal state of affairs, but, when this has been done, the next step is obviously the investigation of the modifying influence of hormones and of drugs. A most important and not entirely academic question is the action of progesterone on the uterus. The history of the investigations into the action of progesterone on the human uterus has recently been given, although somewhat incompletely, by Henry, Browne, and Venning (1950). Very briefly the story is that Knaus and Robson and Reynolds found that under the influence of the corpus luteum the rabbit uterus showed little or no activity and did not react to pituitary extracts. Later, Knaus, by means of an intra-uterine bag and cannula, found that in the first half of the human menstrual cycle the uterus contracted strongly and responded to pituitary extracts, whereas in the luteal phase of the cycle it became inert and incapable of response to posterior pituitary extracts. This view of the action of progesterone was at once widely accepted and has become firmly fixed in nearly all the text-books because it explains so easily the maintenance of pregnancy and the onset of parturition. Numerous investigators, headed by Chassar Moir (1934), have failed to confirm Knaus's findings on the human non-gravid uterus and the majority of observers are in agreement that the spontaneous activity increases throughout the cycle and that the uterus becomes increasingly reactive to pituitary extracts towards the end of the menstrual cycle. No one doubts the original observations of Knaus, Robson, and Reynolds, but their results may have been obtained in unphysiological conditions. The conditions *in vitro* we can dismiss at once as abnormal, for although Robson (1935) showed that there was not any great discrepancy between the reactivity of the rabbit uterus *in vitro* and *in vivo*, I have found that there is a considerable discrepancy in the case of the guinea-pig uterus (Bell and Robson, 1936; Bell, 1941b) and a very great discrepancy in the case of the monkey uterus (Bell, 1942). The only animal in which it has been clearly shown that progesterone causes a quiescence and an unreactivity of the uterus *in vivo* is the rabbit. To be quite fair, it may be that the dosage of progesterone used in the experiments on other species may have been inadequate, as is suggested by the observations of Adler and Bell (1943) on the guinea-pig uterus. A much more likely explanation, however, is that the recording technique is responsible for altering the behaviour of the uterus. This is clearly demonstrated in the case of the rabbit (Bell, 1939, 1941a). In these experiments silver wire stitches were placed in the mesometrium along the uterine border. Some weeks later X-ray photographs of the uterus were made at half-minute intervals. From these graphs were constructed which showed the movements of the uterus in the absence of tension, distension, or of any anaesthetic agent. Oestrogens increased the activity of the rabbit uterus, but treatment with oestrone and progesterone produced long periods of quiescence with intervening large contractions. The same behaviour was observed in the uterus of the pseudo-pregnant rabbit, which must, of course, have supplied its own progesterone in physiological dosage. This leaves us with the simple generalization that in no animal has it definitely been shown that progesterone produces a quiescence of the uterus. At the same time this is a disturbing observation in another direction because it casts doubt on the validity of many observations made *in vivo*. It is scarcely possible to make observations on the activity of the uterus without disturbing it in some way and we are entitled to wonder if many of the discrepant results may not be due to each investigator's loyalty to a certain piece of apparatus. These remarks are not a criticism of the use of progesterone in threatened abortion; but if this treatment is effective it should not be attributed without question to its depression of the uterine activity.

It was first pointed out by Chassar Moir (1936) that the human non-pregnant uterus reacted to the vasopressor fraction of posterior lobe extracts. McLellan (1940), at my suggestion,

examined the reaction of the uterus to the pituitary fractions quantitatively and found that the oxytocic fraction was quite inactive and that all the activity of posterior pituitary extracts could be explained as due to the vasopressor fraction. At parturition, however, Bourne and Burn (1928) found that vasopressin in large doses subcutaneously had no effect on the force or frequency of the contractions, whereas 1 unit of oxytocin given subcutaneously produced a marked increase in uterine contractions. This has been confirmed by Moir (1944). The human uterus 6 to 9 days postpartum responds equally to pitocin, pitressin, or pituitrin (Gardiner and Bradbury, 1940). So far as I know the cause of this reversal has never been investigated but it might provide a clue to the hormonal background of parturition. The reaction of the human (non-pregnant) uterus to vasopressin is exceptional. It produces a relaxation in the uterus of the macacus (Bell, 1942), in that of the rabbit (Robson, 1937), and in that of the cat (Robson and Schild, 1938), but no effect so far as I can find on the guinea-pig or hamster uterus. It is thus quite clear that the problem cannot be investigated by means of animal experiments.

The Cervix Uteri

It has usually been assumed, as mentioned earlier, that the cervix uteri is merely a passive part of the uterus and indeed Reynold's monograph (1949) has little to say on the subject. One of the earliest pieces of work must be that of Fellner (1906), who investigated the movements of the cervix of the dog by means of myographic tongs. He described the hypogastric nerves as being motor to the longitudinal, and the pelvic nerves as motor to the circular muscle of the cervix. Newton (1934, 1937) studied the activity and reactivity of the cervix of several animals *in vitro*. He found that the cervix *in vitro* was quite insensitive to oxytocin during pregnancy although it might be reactive to other hormones, like adrenaline or acetylcholine. The insensitivity of the rat cervix to oxytocin has been confirmed by Genell (1939, 1941). On the basis of these experiments Newton said that if labour is due to the action of an oxytocic substance the advantages of insensitivity on the part of the circular cervical muscle were obvious, and that if it could be shown that the oxytocic principle of the pituitary body caused a simultaneous contraction of the body of the uterus and of the cervix (a severe inco-ordination, as he calls it) the possibility of the posterior lobe hormone being concerned in labour would be ruled out. Since I had already found considerable discrepancy between the behaviour of the uterus *in vitro* and *in vivo*, I thought it well to see if recordings of cervical activity could be made in the living animal (Adler, Bell, and Knox, 1944). It was found that in the guinea-pig, rabbit, and cat at parturition the cervix invariably contracted after the intravenous injection of oxytocin. The threshold dose was usually a little higher than that for the cornu but, more important, the cervical response to a given dose of oxytocin was of much shorter duration than that of the cornu. These findings are in direct contrast to Newton's but we can get out of the difficulty he envisaged by assuming that in the early stages of parturition the circulating oxytocin causes a contraction of the cervix which aids the development of the lower uterine segment, but as the effect of the oxytocic hormone on the cervix is short-lived dilatation can then occur. While this is admittedly highly speculative it gives the cervix an important role in preventing precipitate labour and may be a good example of co-ordination rather than a severe type of inco-ordination as Newton would have it. It is, moreover, easy to speculate further that an exaggeration of this suggested function of the cervix, perhaps by undue sensitiveness to the oxytocic hormone, or because of hypertrophy of the muscle fibres, might lead to cervical dystocia. Incidentally these experiments (Adler *et al.*, 1944) gave indications that the cervix is not quite the same in its behaviour as the rest of the uterus. In the parturient cat, for example, adrenaline makes the cervix contract and the cornu relax. Schild, Fitzpatrick, and Nixon (1951) find that the human cervix in the 8th to 24th weeks of pregnancy may either contract or relax after an intravenous injection of pitocin. All observers agree that the cervix and corpus often show independent spontaneous activity.

The literature on the innervation of the human uterus is so full of controversy and contradiction that it drives the reviewer to despair. Many dog-

matic statements are made; many analogies are drawn between the rectum and its sphincter and the uterus and its sphincter; many deductions are drawn from the apparent action of drugs on the progress of labour: but there is almost an entire absence of objective evidence for any of these views. This subject is reviewed by Gruber (1933). In particular, information as to the influence of the nerve supply of the uterus on the cervix is rather scanty. Many pretty diagrams are given of the disposition of the fibres in the uterus in longitudinal, circular, and spiral directions on which the parasympathetic and sympathetic nerves are alleged to have different actions; but it seems rather difficult to find verification of these pictures by actual dissection (Wagner, 1950).

Schofield (1952a, 1952b), working in my department, has recently made a new attempt to throw a little light on nervous effects on the uterus. In view of species differences it was thought wise in the first instance to confine investigation to the rabbit. In this animal stimulation of the hypogastric nerve (the sympathetic supply) causes a rise of tone and an increase in frequency of contractions of both the cervix and the cornu in both oestrous and parturient animals. The effect can be imitated by either adrenaline or noradrenaline and these have been detected in the blood, after hypogastric stimulation, by Mann and West (1951). In 21 experiments (Schofield, 1952a) the *nervus erigens* was stimulated but in only 4 cases were any positive effects obtained and in these both the cervix and the cornu showed a rise in tone, and an increase in frequency of contractions. The augmented activity of the rectum showed that stimulation was, in fact, effective. No evidence could be obtained for any inhibitory fibres in the hypogastric nerve.

Much evidence has accumulated to show that normal uterine motility continues in the absence of nervous connexions. It may be that the nervous supply is not important in labour or it may only mean that we have yet to find the appropriate stimulus for the production of reflex effects. It may be that the nerves preside over the blood supply or the glandular secretions, or they may have some function in regulating the behaviour of the cervix and of the body of the uterus during coitus.

There appears to be a demand from obstetricians for a drug with an antispasmodic effect on the cervix. A number of clinical papers have been written to suggest that pethidine shortens labour (Gallen and Prescott, 1944; Spitzer, 1944; Gilberg and Dixon, 1943; Mackenzie, 1943), but there is no satisfactory objective evidence that the effect is produced by a relaxation of the cervix as is usually suggested. The good results, if real, could be attributed to the sedative effects of pethidine. Clinical experiments with other antispasmodics, such as trasentin, syntropan, and dihydroergotamine, have not proved very conclusive.

In the case of the rabbit, Schofield (1952b) has found that pethidine and trasentin have little or no effect on the cervix or cornu. Syntropan, on the other hand, stimulated both cervix and cornu. Dihydroergotamine showed an inhibitory effect more marked on the cornu than on the cervix, but this effect was not constant. Isoprenaline consistently produced a marked inhibition of cervical activity. There was also a similar effect on the cornu but this was short-lived. These properties would appear to make isoprenaline the ideal cervical antispasmodic were it not for its adverse cardiovascular effects. These experiments, even although they are only relevant to the rabbit, encourage us in the hope that a cervical antispasmodic will eventually be found for use in human obstetrics. This might be a chemically modified version of isoprenaline, or perhaps a combination with a pressor drug to counteract the depressor effect of isoprenaline. It is to be hoped that similar experiments will be carried out in other species and that the more objective methods of the physiological laboratory will be applied to the human problem. It is encouraging to know that Schild, Fitzpatrick, and Nixon (1951) have made a promising start along these lines. I feel certain that the cervix is something more than the mere end of the uterus. Further study of the control of its motility, both hormonal and nervous, is necessary but there are other aspects of its function, such as the softening which occurs in pregnancy, which are as yet quite unexplained. It is to be hoped that, with traffic in both directions between the physiology laboratory and the obstetrical department, definite progress will be made.

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2. Professor W. C. W. Nixon, M.D., F.R.C.S., F.R.C.O.G.
Director of Obstetric Unit, University College Hospital Medical School, London

I am deeply conscious of the honour of being invited to open this symposium together with Professor George H. Bell, who has made such extensive studies of the physiology of uterine action. The combination of a physiological and clinical approach to the problem of abnormal uterine action is a sign of the times since many clinical problems are now being solved in the physiological laboratory.

Pharmacological Response and Histological Pattern of the Human Cervix

It is not my intention to be repetitive nor competitive with regard to what Professor Bell has told you. He has left it to me to mention briefly some studies in the human field relating to the activity of the cervix which may have some bearing on the course of labour.

Activity of the Cervix

There is evidence to show that the human cervix in the first two trimesters of pregnancy has an activity independent of the corpus. Schild, Fitzpatrick, and Nixon (1951), using intrauterine balloons, have shown this.

Fig. 1 shows that contractions of the cervix balloon do not occur at the same time as those of the corpus and are not caused by mechanical transmission of pressure from above. It shows also that an injection of ergometrine causes a greater contraction of the cervix than of the corpus.

Fig. 3 illustrates a selective response of the cervix to methyl ergometrine, the corpus remaining quiescent. On the other hand, with an injection of oxytocin there was an abrupt rise of intrauterine pressure without any effect on the cervix.

In Fig. 4 the cervix is seen to relax—3 times in succession—under the influence of oxytocin.

From these observations it would seem that oxytocin is, at present, the drug of choice in stimulating the corpus when a *vis a tergo* is required, for instance, in the treatment of abortion. In labour, the retention of the placenta which sometimes follows the administration of ergometrine during the second or third stages may be due to the active contraction of the cervix from the stimulus of this drug as shown above.

Histological Topography of the Cervix

It has long been held that the cervix is composed essentially of fibrous tissue. If this were so then the above records of cervical activity could not have been obtained in the complete absence

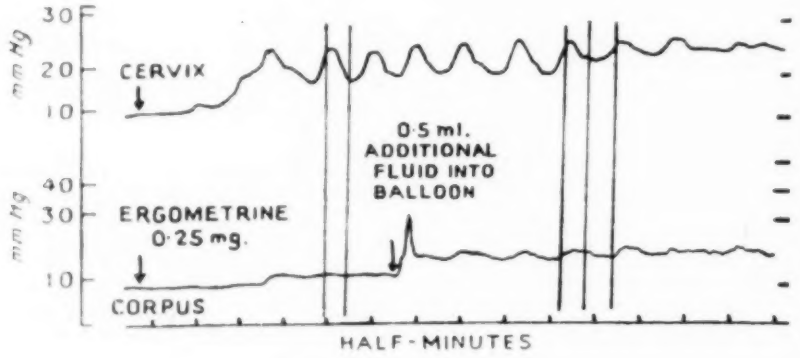

Fig. 1

At 20 weeks. Contractions of cervix independent of corpus. Effect of ergometrine greater on cervix than on corpus

FIG. 2

Distribution of muscle (dark staining) in cervix during labour (death from post-partum haemorrhage)

(By courtesy of Dr. Hughesdon)

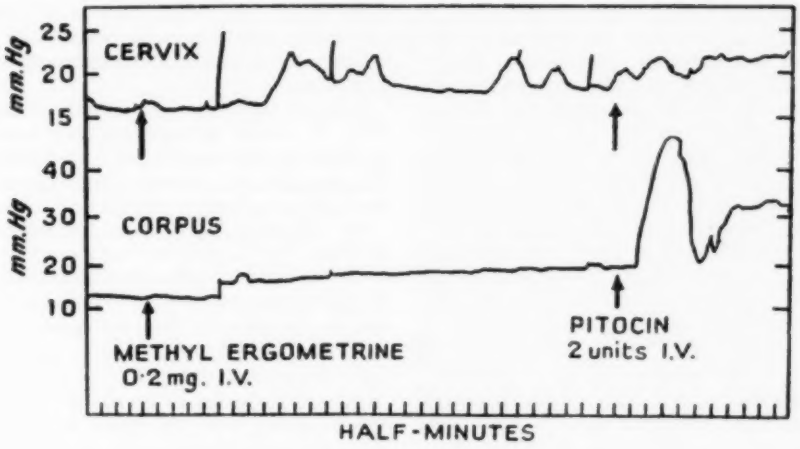

FIG. 3

At 22 weeks. Intravenous methylergometrine (0.2 mg.) causes contractions of cervix, the corpus remaining quiescent. Oxytocin causes an immediate effect on the corpus without any on the cervix.

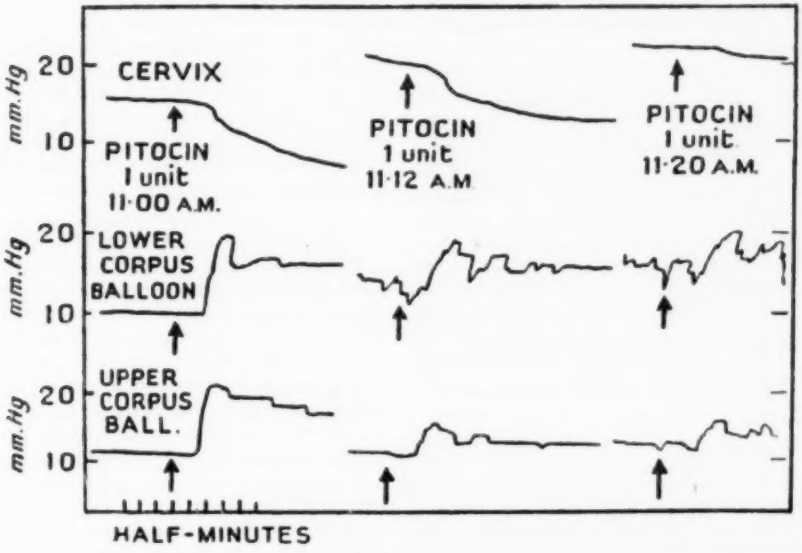

FIG. 4

Triple cannula. On three successive occasions oxytocin (Pitocin 1 unit) causes rise of pressure in the uterus but fall in the cervix

of muscle contractility. Hughesdon (1951) by special staining technique has revealed the presence of both immature (intrinsic) and mature (extrinsic) muscle fibres. The latter are arranged in such a way that they can either assist or retard dilatation of the cervix.

The distribution of muscle and collagen can be seen from Fig. 2. The specimen is taken from the lower two-thirds of the cervix of a primipara who died from postpartum haemorrhage and shows: (1) a continuous layer of muscle externally, running up from the vagina; (2) muscle occupying about half the thickness of the cervix; (3) internally the tissue is congested, and ecchymotic.

Hughesdon (1952) has studied further the anatomy of the wall of the human cervix in pregnancy and labour. These studies serve to explain on an anatomical basis the variation in dilatation of the cervix, especially in relation to long labour. They are a major contribution to the elucidation of the problem of irregular uterine action.

The Pattern of Uterine Contractility

During the last decennium increasing attention has been paid to the construction of apparatus for the accurate recording of uterine contractions. It is now possible to record with accuracy the contractions of the human uterus (Alvarez and Caldeyro Barcia, 1950; Halliday and Heyns, 1952; Karlson, 1949; Lorand, 1942; Reynolds, Heards, Burns, and Hellman, 1948; Williams and Stallworthy, 1952). Both regular and irregular action can now be depicted in graphic form and the effect of drugs upon uterine tone and contractions can also be observed. However, up to date the activity of the cervix during labour has received little attention, due probably to technical difficulties. Until more is learnt of the factors that influence the changes in the lower pole of the uterus (including the cervix) the treatment of inco-ordinate uterine action must remain empirical.

Classification of Irregular Uterine Action

There is little to add to Jeffcoate's (1950) classification which goes far to reconcile most of the clinical and experimental observations so far recorded. He deplores the present connotation of the term uterine inertia, although MacRae (1949) uses this in a generic sense to include: (1) atonic uterus; (2) cervical achalasia; (3) arrhythmic uterus; (4) hypertonic uterus; (5) local uterine constriction; and (6) general uterine constriction.

Arthur (1949) of Newcastle has made a special study of cervical dystocia and has found this complication present in 1.5 per cent of deliveries. His cases fall into three clinical groups according to the type of cervix: hard, tense, or hanging.

All will be familiar with the contraction ring of White (1913), but much confusion has arisen in the literature on both sides of the Atlantic as to what is meant by this. The difference in connotation is probably the reason for the high incidence (1.67 per cent in 13,575 deliveries) of this complication reported by Rucker (1946). White (1949) has sought to clarify the position and has pointed out that a ring has often been diagnosed on abdominal palpation when, in fact, it was the top of the oedematous bladder that was being palpated.

Whatever classification one adopts and whatever one means by uterine inertia, uterine atony, or cervical dystocia, the result is the same, namely, long labour with slow dilatation of the cervix.

It is the prolongation of labour that is the clinical problem and this aspect will now be discussed. In Britain labour is usually considered to be prolonged when it has lasted longer than 48 hours. Evidence will be presented to show that in the interests of the mother and baby this figure should be reduced to 30 or even 24 hours.

The Present Study of Long Labour

Professor Gordon King (1950) of Hong Kong has been kind enough to provide me with some figures relating to 48-hour labours. During the years 1948–49 there were 8,850 deliveries in Tsan Yuk Hospital, and only 17 mothers had labours lasting more than 48 hours. Of these, 11 delivered themselves spontaneously. There were 3 stillbirths but no maternal deaths.

The operative delivery rate for the above years was just under 3.5 per cent: forceps 2.5 per cent; version 0.32 per cent; craniotomy 0.04 per cent; Caesarean section 0.62 per cent.

I will now quote from his letter: " The average Chinese patient approaches labour with considerably less apprehension than the average English

or American woman. I think that is one of the reasons for the small number of cases of prolonged labour and for the low operative delivery rate, just under 3.5 per cent, for the two years mentioned, including forceps, version, craniotomy, and Caesarean section."

These remarkable figures led me to wonder if there was a racial factor involved in long labour, and whether a study of geographical distribution might give information in support of this.

Geographical Distribution

At a conference on Maternity Care (1952) arranged by the World Health Organization I had the opportunity of meeting obstetric colleagues from other hemispheres. They commented on the ease with which many women in economically underdeveloped countries gave birth to children compared with the difficulties which some women in the more developed countries experienced. They have very kindly furnished me with figures from their respective clinics concerning duration of labour in the year 1950. These have been analyzed by Dr. H. L. Hartley of the Department of Statistics, University College, London.

In attempting a comparison of the centres it must, of course, be realized that any differences found between the centres might be due to numerous causes—racial, physiological, environment, climatic, different standards as to timing of labour onset, etc.

(1) When comparing the percentage of all deliveries, irrespective of labour duration, among primiparae (under 22 years) it was found at University College Hospital, London, that only one-quarter of the primiparae were under 22 years old. At Hong Kong and Santiago about one-half, and at the other centres about three-quarters, were under 22.

(2) At certain centres it was found that for primiparae the older the mother the greater was the risk of labour of over 48 hours.

(3) There was evidence at all centres, except Djakarta, that, given a constant age, the multipara was less likely to have a long labour.

(4) At University College Hospital among the younger primiparae (under 22) it was estimated that labours lasting longer than 36 hours had an incidence of about 9 per cent, whilst for young multiparae (under 26 years) the incidence was only 1.5 per cent.

Other Factors in Aetiology

(1) *Previous Infertility*

My colleague, Dr. G. I. M. Swyer, has investigated 96 patients who had attended the Fertility Clinic and who subsequently had a delivery. He found that 78 of the labours were under, and 18 (18.7 per cent) were over, 30 hours. Thus long labour was a significant feature.

There was a negative correlation in respect of age, previous abortion, dilatation and curettage operation, duration of voluntary sterility, type of cervix, spasm of tubes at time of insufflation, and marital difficulties (vaginismus, etc.). He was unable to detect a special somatotype in the long labour group.

(2) *Psychological Aspects*

All will be familiar with the contributions of Dr. Grantley Dick Read which have served to remind us of the importance of attending to the emotional as well as the physical aspects of pregnancy and labour. "Tense mind, tense cervix" is a facet of the problem of long labour which should not be neglected.

Dr. Elizabeth Tylden is attached to my clinic for the purpose of studying psychological problems associated with the birth process. She has not been able to find a higher incidence of previous psychosomatic disorder or of previous excessive fear of childbirth among women who have had long labour compared with a control group. There has been a high incidence of long labour in the type of women whose nervous breakdown was related to reproduction and the reproductive cycle. Long labour has been related to the type of breakdown in which depression and anxiety were the presenting symptoms and which were relieved by electroconvulsive therapy.

In the *Report on Maternity Care* (World Health Organization, 1952) reference is made to the fact that in the more economically developed countries psychological factors influence the duration of labour. The hospital environment which deprives women of the moral support they receive when delivered in their own homes may also sometimes be the cause of a long delivery.

It should be possible in Britain to test the

validity of this view by comparing home and hospital deliveries in similar groups.

(3) *Types of Cervix Uteri*

Dr. D. Pells Cocks, Obstetric Registrar, University College Hospital, has evolved the following classification of the cervix (Fig. 5). At the time of surgical induction of labour the cervix has been carefully examined and a note made as to its type.

The position of the cervix in relation to the sacrum—" sacral os "—(anterior sacculation) has been especially noted.

The purpose of this investigation is to discover whether a specific type of cervix is associated with long labour.

Up to date, the cervix has been " typed " in 68 cases. The duration of labour and the induction–labour interval is seen in Table I.

There were two further cases observed in which the induction–labour interval exceeded 8 days. If these are included the figure of 32.2 hours rises to 84.4 hours.

Dr. H. L. Hartley has tested the significance of the above figures. He finds that the percentage of cases with labour over 36 hours is significant according to whether the cervix is type 1 or 2. There is an indication (requiring more data for confirmation) that type 2 results in a longer labour period than type 1 and that cases with a " sacral os " (S.O.) in type 1 tend to have a longer induction–labour interval.

(4) *Malposition of the Foetal Head*

It has long been known that prolonged labour is often associated with a posterior position of the occiput. This has been a factor in the long labour cases at University College Hospital.

Fig. 6 has been prepared from data collected during the years 1946 to 1951. All cases of pelvic contraction have been excluded. The high incidence of occipito-posterior position in the 48-hour labour group is statistically significant.

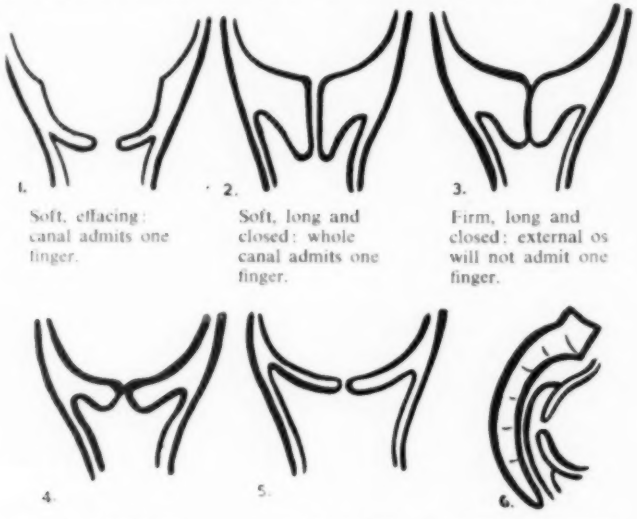
1.
Soft, effacing: canal admits one finger.
2.
Soft, long and closed: whole canal admits one finger.
3.
Firm, long and closed: external os will not admit one finger.
4.
Firm and short external os admits one finger, internal os rigid.
5.
Cervical anomalies pinhole os, duplication, etc.
6.
Sacral os, anterior sacculation: occuring in any of the previous types.

FIG. 5

Types of cervix before onset of labour at time of surgical induction (artificial rupture of membranes)

TABLE I
Relation of type of cervix to labour duration and induction–labour interval

Type of cervix	No. of cases with labour: Under 36 hours	Over 36 hours	All cases	Percentage of cases with labour over 36 hours
1	35	8	43	19
2	10	8	18	44
Other types	5	2	7	—

Type of cervix	Sacral os (S.O.)	No. of cases	Mean length of labour		Mean length of latent period (induction–labour interval)
1	Without S.O.	37	18.3	18.1	11.4*
1	With S.O.	6	16.6		32.2†
2	Without S.O.	11	28.2	33.1	Too few cases with known latent period
2	With S.O.	7	40.9		

* Based only on 30 cases.
† Based only on 4 cases

It is interesting to note that in the 1949 report of the Liverpool Maternity Hospital there were 38 cases of prolonged labour in which 10 were delivered by Caesarean section. Of these 10 cases, 8 were associated with a posterior position of the occiput. Again, at Queen Charlotte's Maternity Hospital in 1949 there were 52 cases of long labour, 10 of which were terminated by Caesarean section, and in these the occiput was posterior in 5.

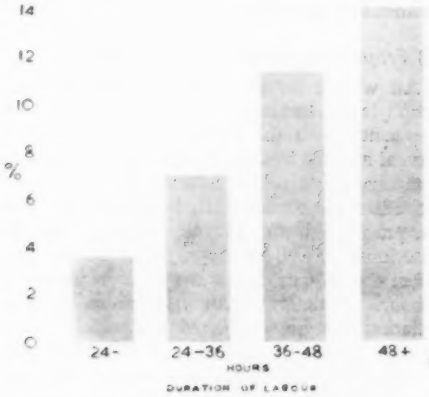

FIG. 6

Percentage of mothers with occipito-posterior, classified according to duration of labour
Association of long labour with occipito-posterior position

In an attempt to summarize the views of the team at University College Obstetric Hospital who have been investigating the problem of long labour and its aetiology, we would submit the following points for consideration. Granted the sort of patient who is relatively infertile tends to grow a big baby, has a long, hard, "sacral" cervix, and an occipito-posterior presentation; add to this sort of psychological make-up which reacts to adversity with loss of insight, depression, and a state of tension; add also marital or general social stress, then long labour is more likely than if these factors were not coincident.

THE HAZARDS OF LONG LABOUR

Dr. H. L. Hartley has analyzed samples of deliveries over the years 1946 to 1951. The labours have been grouped according to duration in hours: under 24, 24–36, 36–48, and over 48. The four duration classes have been used as strata and a larger sampling fraction was used for the long duration classes. Of the data submitted to statistical analysis only those factors which are statistically significant with regard to long labour will be presented.

Maternal morbidity has been classified according to whether the temperature remained below or exceeded 100.4°F. (38°C.) (high pyrexia). It will be seen that this rises steeply after labour has lasted 36 hours (Fig. 7). This increase in maternal

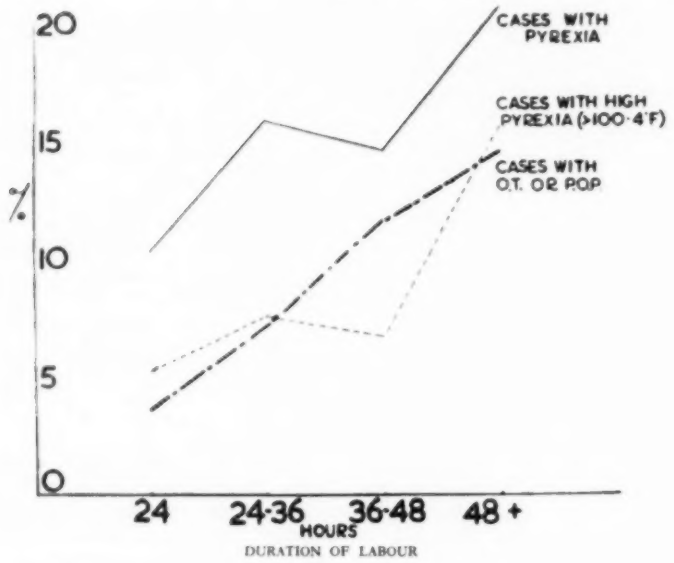

FIG. 7

Foetal morbidity for groups of patients classified according to duration of labour

Maternal morbidity associated with long labour

morbidity is also associated with prolonged labour in which there is a malposition of the head (occipito-transverse—O.T.—or posterior —P.O.P.).

Fig. 8 shows that maternal morbidity is higher when the membranes have ruptured before labour.

Foetal mortality increases markedly after a labour of 36 hours. This applies to stillbirths and the combined mortality of stillbirths and neonatal deaths (perinatal mortality) (Fig. 9).

From Fig. 10 it will be seen that the length of time the membranes have ruptured has not had much influence on the stillbirth rate and perinatal mortality.

TREATMENT OF LONG LABOUR

Great caution is required in assessing the value of treatment in cases of long labour. This complication is one in which it is easy to laud a particular type of therapy when in fact *vis medicatrix naturae* played the major part in the successful termination of the labour.

(1) *Prophylactic treatment*

All will be familiar with the importance of prophylactic treatment. This should start in pregnancy with the building up of a healthy mental attitude by the mother to what should be a normal event. Again, during labour it is the attitude of the attendants that can sometimes mar the process of birth. They need to appreciate the emotional as well as the physical changes that affect the mother during the different stages of labour. A timely sedative, attention to fluid balance, the prevention of acidosis by intravenous glucose (not saline) will play their part.

After 24 hours of labour a vaginal examination should always be done. The case must be carefully reviewed, and ideally the mother should now come under the closer scrutiny and care of a " dystocia " team working in a different section of the labour ward suite.

(2) *Treatment of established case of Long Labour*

(a) *Amyl nitrite or adrenalin.* The value of these drugs has been proved in cases of contraction ring.

(b) *Pitocin drip infusion.* In cases where the cervix dilates slowly and the uterus is hypotonic this is a valuable form of treatment. In the presence of disproportion, a malpresentation, excessive parity, a hypertonic uterus, the use of an oxytocic is absolutely contra-indicated. Credit must be given to Theobald *et al.* (1948) for introducing this therapy. They claim to have had success in 60 per cent of cases of long labour.

Dr. C. N. Smyth, through the generosity of the Nuffield Foundation, is working in my department on the problem of long labour. He has prepared Fig. 11 from observations he has made on the relation between the rate of pitocin drip and the frequency of uterine contractions. It is seen that the frequency of contractions increases with the rate of the drip up to 30 drops per minute, after which a further increase in the rate has been found to heighten uterine tone and cause spasm. The drip was 5 per cent glucose with 10 units pitocin per litre and the cases not in labour although at term. At 20 drops a minute the contractions and tone were maintained constant for a long period at values resembling normal labour.

The advantage of giving pitocin by this method is that the dose of this powerful and sometimes dangerous oxytocic can be properly controlled, unlike repeated intravenous or intramuscular injections. It is possible to adjust the drip so that the concentration of the drug approximates to the physiological titre in the blood during labour.

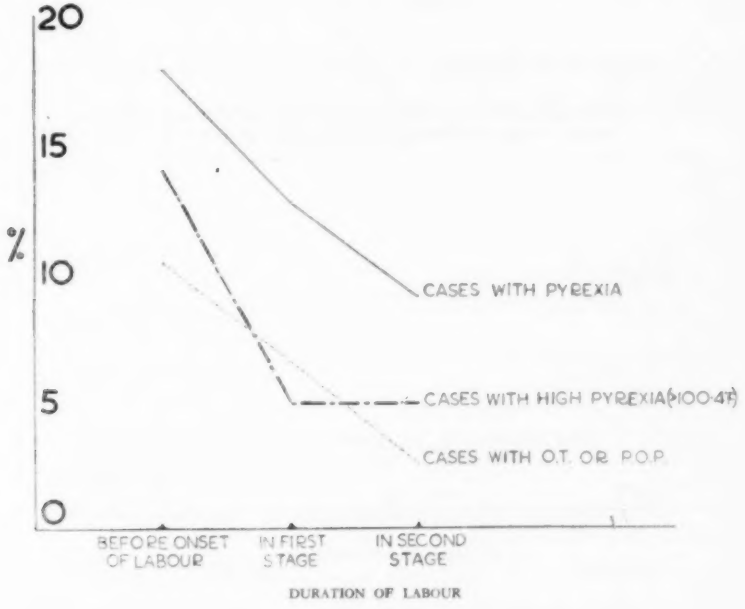

FIG. 8

Maternal morbidity in relation to length of time membranes have been ruptured.

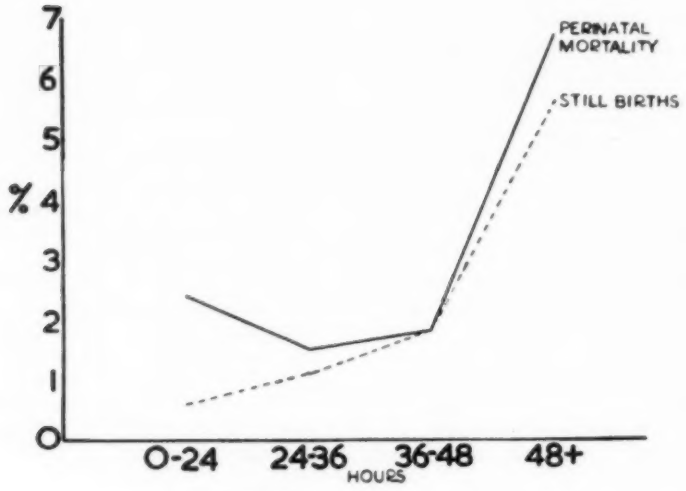

FIG. 9.

Foetal mortality for groups of patients classified according to duration of labour

Stillbirths and the combined mortality of stillbirths and neonatal deaths (perinatal mortality) increases after 36 hours of labour

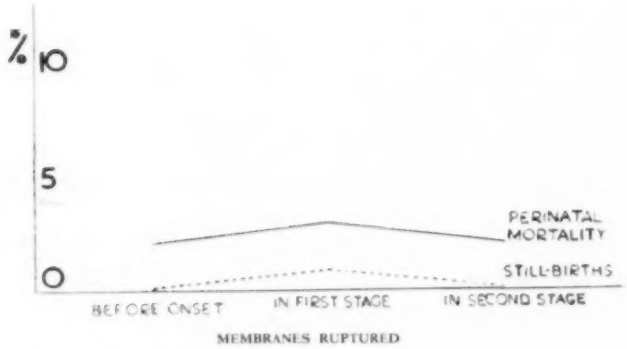

FIG. 10

Foetal mortality for groups of patients classified according to duration of labour after rupture of membranes. Perinatal mortality and stillbirths are not influenced by time the membranes have been ruptured.

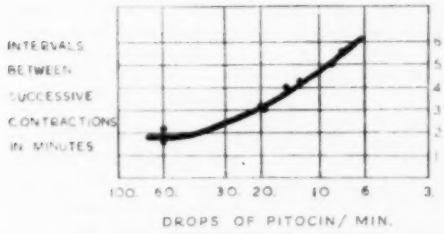

FIG. 11

Relation of frequency of contractions to rate of pitocin drip

(c) *Dihydroergotamine* (*DHE* 45). This drug has not as yet had extensive trials in this country. Gill and Farrar (1951) of Sydney have reported very favourably on its use in long labour (43 cases). In 80–90 per cent of these cases there was relaxation of the cervix with a speedy termination of labour. Its effect seems to be due to its sympathicolytic action and it is, therefore, particularly indicated in cases where the uterus is hypertonic and the cervix tense and rigid. My own experience of this drug has been limited to those cases in which the dose has been 0.25 mg. (intramuscular) repeated at 4-hourly intervals for 3 doses. But my colleagues from Sydney tell me that this amount can be given at 2-hourly intervals repeated 5 or 7 times if necessary. In this dosage they have not seen any toxic effects on either the mother or foetus.

(d) *Caudal analgesia.* The recent report by Arthur and Johnson (1952) has again emphasized the benefit of this type of treatment in cervical dystocia. It would seem that this treatment deserves a wider trial.

But despite the types of treatment outlined above the uterus may remain refractory and the cervix not dilate.

Fig. 12 is a tocographic tracing showing the failure of intravenous glucose, pitocin drip,

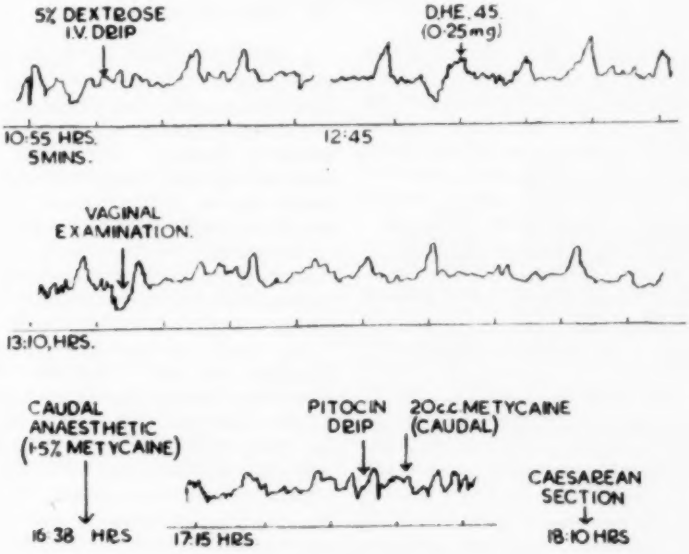

FIG. 12

Some methods of treatment of long labour

Tocographic tracing. Failure of medical treatment to influence dilatation of cervix. Caesarean section for foetal distress

dihydroergotamine, and caudal analgesia to influence the dilatation of the cervix. In view of foetal distress, the labour was terminated by Caesarean section.

Fig. 13 illustrates the mode of delivery of cases of long labour (48 hours) at University College Hospital during 1950–51. It will be seen that about one-third of the cases were delivered by Caesarean section. This operation is being used more and more to terminate labour complicated by abnormal uterine action. The good results of conservative treatment as exemplified by Schmitz, Smith, and O'Dea (1950), and Willson and Alesbury (1951) do serve to remind us that Caesarean section must not be considered a panacea for protracted labour. This operation is no more than a mechanistic escape from a difficult situation. The plea I would make is that it is of value in reducing perinatal mortality and maternal morbidity when performed neither too late nor too early in labour.

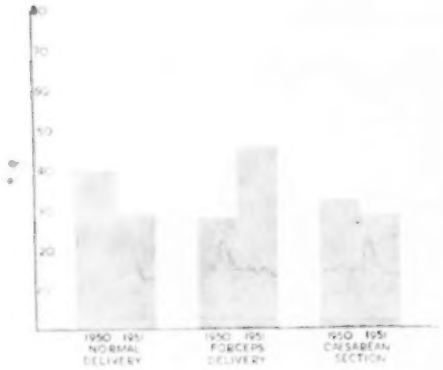

FIG. 13

Comparison of methods of delivery in cases of prolonged labour 1950–1951. One third delivered by Caesarean section

When a woman has been in active labour for 24 hours a careful review of her case should be made; when after 36 hours she is still undelivered and cervical dilatation is stationary, then the possibility of terminating her labour by Caesarean section must be seriously considered provided modern methods of medical treatment have been given a fair trial.

CONCLUSION

The problem of abnormal uterine action in labour is one which will be solved eventually by a team of those working not only in the clinical but also in the non-clinical fields. The physicist and biochemist are playing an increasing role in the elucidation of clinical problems. Up to date, the obstetrician has contributed little except to resort earlier to Caesarean section. He has thus been able to reduce maternal morbidity and perinatal mortality, but has added little to the fundamental solution of the mystery of abnormal uterine action.

This trend in medical research is inexorable, so that few of us can now support Ruskin in his outburst: "What", he cried in righteous wrath, "what are *we* good for but to damage the spire, break down half the houses, burn the library—and declare there is no God but chemistry."

I wish to express my gratitude to those colleagues in distant lands who generously furnished me with data relating to duration of labour: Professor O. Avendano, Hospital del Salvador, Santiago (University of Chile); Professor Gordon King, University of Hong Kong; Dr. S. Pandit, Directorate-General of Health Services, New Delhi, India; Professor S. Prawirohardjo, Department of Obstetrics, School of Medicine, Djakarta, Indonesia: Dr. C. Rendle-Short, Head of Obstetric Department, Mulago Hospital, Kampala, Uganda.

My thanks are especially due to Dr. H. L. Hartley, of the Statistical Department, University College, London, for the compilation of the statistical appendix. My colleague, Dr. G. I. M. Swyer, very kindly supplied me with data from the Fertility Clinic of University College Hospital, and Dr. Elizabeth Tylden has given me the benefit of her opinion on the psychological aspects of long labour. I am grateful to Dr. D. Pells Cocks, Obstetric Registrar at University College Obstetric Hospital, for allowing me to use material he has been collecting.

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DISCUSSION

DR. E. ARTHUR WILLIAMS (Oxford)

THE menace and anxieties of abnormal uterine action remain a besetting problem, and although clinical management has improved greatly, as the lessened mortality and morbidity show, yet understanding of defective uterine action has advanced but very little. This has stimulated the many investigations by tocography (Alvarez and Caldeyro Barcia, 1950; Dodek, 1932; Nixon, 1951; Reynolds, 1949), a procedure which reflects the pattern of uterine action more clearly than the most careful clinical examination.

In February 1952 Mr. Stallworthy and I published a simple method of internal tocography. We described how a polythene tube passed through the cervix into the amniotic sac, and connected to a manometer, enabled continuous records to be made of uterine behaviour throughout labour.

We claimed that the method was simple, accurate, and safe. It was considered important that the mercury meniscus should bear a fixed relationship to the patient. For convenience we arranged it at the level of her symphisis pubis, and in this way were able to make comparisons from one patient to another. We stress the need for this precaution; otherwise false records will be obtained. This would be regrettable, for many workers are interested in that elusive factor "basal intra-uterine pressure" in such conditions as inertia, pre-eclampsia and hydramnios.

In normal labour a woman delivers her baby in the optimum time without injury. It has been shown that the basal intra-uterine pressure lies between 4 and 10 mm. Hg (Williams and Stallworthy, 1952). First-stage contractions raise the intra-uterine pressure to 40, 70, or 90 mm. Hg. They recur regularly and smoothly, systole being abrupt and diastole more leisured.

During the second stage the pressure rises to 120, or even 180 mm. Hg, and records show that this increase is due to the involuntary expulsive powers superimposed on uterine contractions. Relaxation between contractions is normally complete, and these "physiological rests" are of the greatest importance, for during them the infant makes good the deprivations of oxygen which it suffers during contractions, and the mother is rested for further effort.

When the uterus behaves other than in this well-ordered way its action is abnormal. The abnormality is sometimes of little moment, but it may be serious and kill mother or child, or both.

It is difficult to classify abnormal uterine action except in broad categories. It is certain that uterine action may be deficient, it may be excessive, and it may not be co-ordinated. Deficient and inco-ordinate action leads to prolonged labour with its well-known dangers (MacRae, 1949). We have found ample evidence of deficient uterine action among some patients whom we have investigated during inertia. The records show clearly that contractions are feeble and infrequent.

We believe that hypertonic inertia is a confusing and misleading term, for it suggests that the basal intra-uterine pressure is raised. We have found no evidence for this. So-called hypertonic inertia is characterized by erratic and unpredictable uterine action, so that the intra-uterine pressure varies enormously from one contraction to the next. The contractions may be excessively painful and the cervix dilates grudgingly if at all. The uterus is irritable and contracts when palpated. Contractions tend to run into one another and produce tetanic spasms. Uterine action is inco-ordinate. The gradient of activity from fundus to cervix does not favour easy labour—for there is no fundal dominance. Hellman, Harris, and Reynolds (1950) have shown that there may even be "reversal" of the normal gradient. It is a very real entity—and our records show exaggerated pressures during irregular contractions, and yet the cervix does not yield. It seems clear that in these circumstances the entire uterine muscle may contract—fundus, mid-uterus, and lower segment.

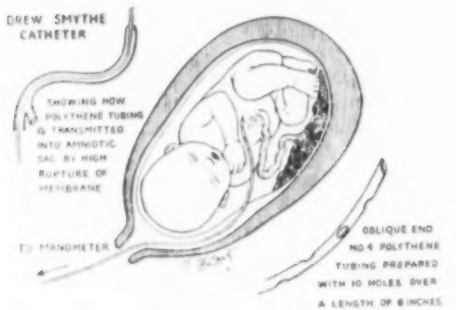
DREW SMYTHE CATHETER
SHOWING HOW POLYTHENE TUBING IS TRANSMITTED INTO AMNIOTIC SAC BY HIGH RUPTURE OF MEMBRANE
TO MANOMETER
OBLIQUE END NO 4 POLYTHENE TUBING PREPARED WITH 10 HOLES OVER A LENGTH OF 6 INCHES

FIG. 1

The technique and principles of internal tocography by the Oxford method.

In this state the uterus is excessively sensitive to pitocin, and its violent response may cause disaster even when the dose given is small, judged by normal standards. But even in these circumstances the patient will not come to harm if pitocin is given in such amounts that the uterine action is contained within the safety limits of 20 mm. Hg basal intra-uterine pressure and 80 mm. Hg at the acme of contractions. We recently studied such a patient who had laboured intermittently for 5 days with ruptured membranes. Over a period of 4 hours she tolerated only 2/3rds of a unit of pitocin given intravenously in glucose solution (1 unit pitocin to 1 pint 5 per cent glucose). This was sufficient to cause progressive cervical dilatation. In 8 hours she progressed from 1 finger to full dilatation.

There are certain conditions which predispose to normal uterine action. Almost everyone is convinced that peace of mind is important and that a labouring woman should avoid too early recumbency. A full bladder and a loaded rectum are familiar causes of delay, and neglect of them may cause disordered function. Our records show how deterrent a loaded rectum may be to progressive labour.

During the last 10 years an increasing number of obstetricians have begun to explore the possibility of using oxytocic drugs in labour to improve uterine action (Woodbury *et al.*, 1938; Eastman, 1947; Theobald *et al.*, 1948; Hellman *et al.*, 1950; Nixon, 1951). We found that, if pitocin was given in 2½-unit doses subcutaneously to induce labour, uterine contractions would generally commence in about 7 minutes and the pitocin effect would last for 45 minutes. The pattern and strength of contractions depended on the rate of absorption and of uterine sensitivity, and, although in the majority of instances such doses of pitocin did not cause

[Continued on page 640

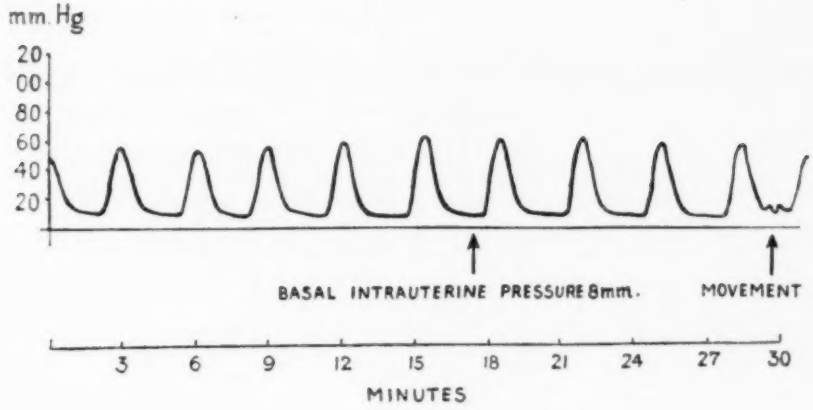

FIG. 2

Part of the record of a normal first stage of labour. The contractions recurred smoothly and regularly. Basal intra-uterine pressure is about 8 mm.Hg. During contractions it rises to about 60 mm.Hg.

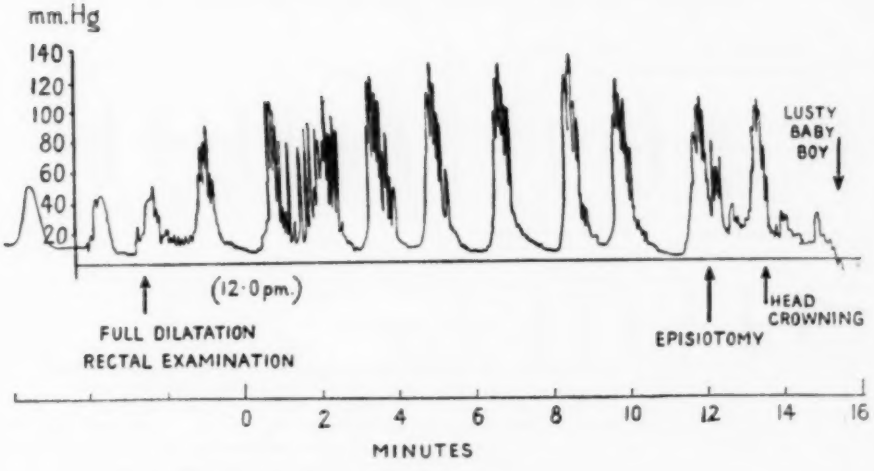

FIG. 3

Part of a record showing normal second-stage labour in a multiparous patient. The intra-uterine pressure rises to 160 mm.Hg, the increment being due to bearing-down effort

FIG. 4

Mrs. D., para 7. Record shows a typical pitocin drip induction of labour; 2½ units per pint. Labour progressed smoothly. Control excellent.

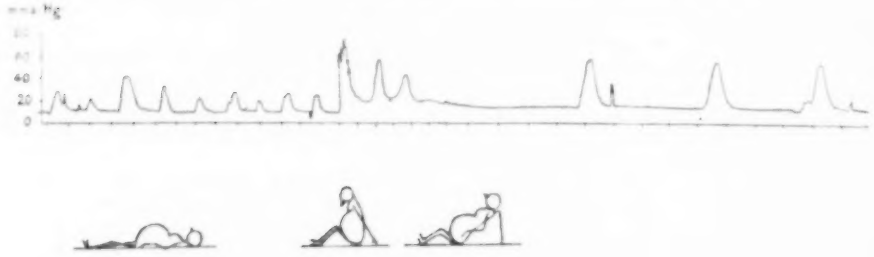

FIG. 5

Mrs. T., aged 33, primipara. This patient had commenced in labour after the membranes ruptured spontaneously. The head was high and the occiput posterior. Her pelvis was large; when she sat up the head pushed in, and came to fit the cervix. This altered the character of her uterine action, and the records show how in certain circumstances an adequate presenting part well applied to the cervix can influence uterine behaviour profoundly. (The variation in drum speed was produced unintentionally.)

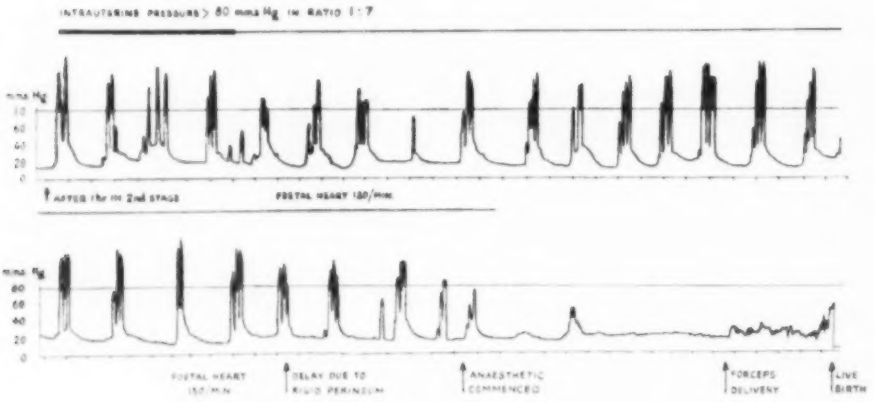

FIG. 6

Mrs. L., aged 21, para 0. The second stage lasted for 2 hours, because of delay due to a posterior position. The uterus relaxed well between contractions, and intra-uterine pressure exceeded 80 mm.Hg for only 1 minute in 7. At forceps delivery, left occipito-posterior, mid-cavity.

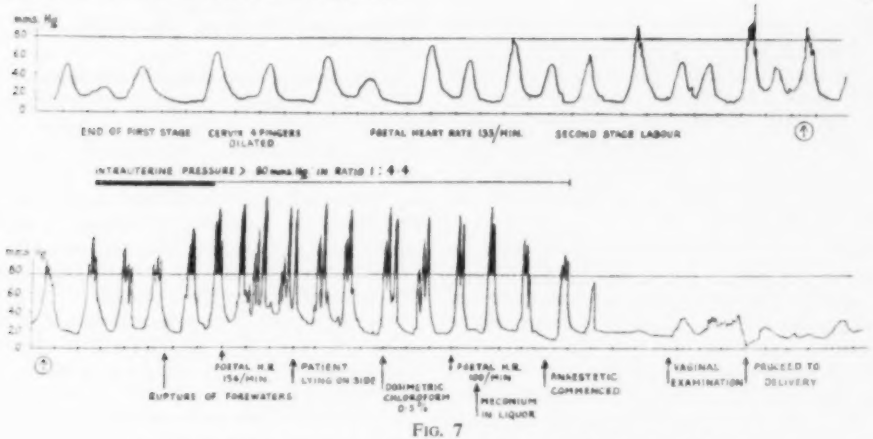

FIG. 7

Mrs. M., aged 23, para 1. A violent second stage of labour, with intra-uterine pressure sustained above 80 mm.Hg for 1 minute in 4½ minutes. The uterus relaxed incompletely between contractions. Foetal distress developed in a period of 20 minutes and the baby was rescued by anaesthesia and forceps delivery. The peak intra-uterine pressure was 160 mm.Hg.

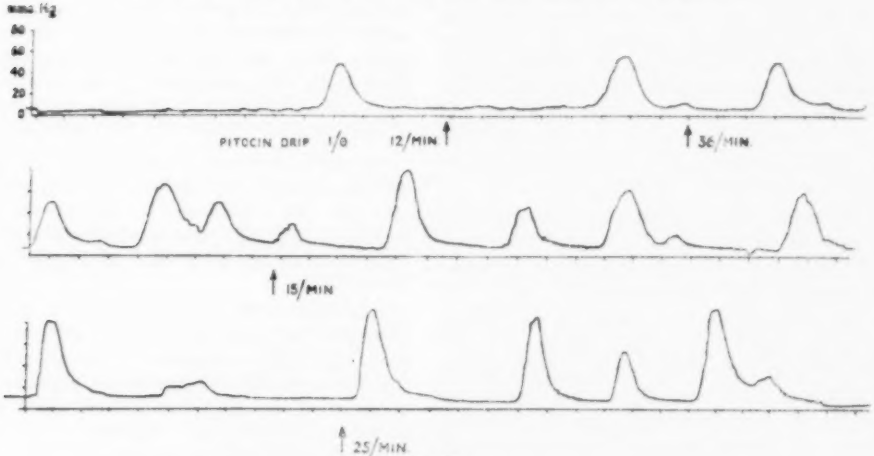

FIG. 8

Mrs. K., aged 29, para 1. Had "laboured" intermittently with ruptured membranes for 6 days. Her uterus was irritable, and contracted when palpation was performed. Over a period of 4 hours she only tolerated ¼ of a pint of 5 per cent glucose containing pitocin 1 unit per pint. Yet this was sufficient to bring her to full dilatation in 8 hours, from a cervix which was tight and would only admit 1 finger.

The patient had acquired since her first confinement severe asthma, urticaria and chronic dermatitis.

The record shows how responsive the uterus was and how it tended to act erratically. (Pitocin 1 unit per pint. The figures refer to drip speed in drops per minute.)

anxiety, we observed on occasions that the initial contractions would run into one another, producing a tetanic spasm with obvious risks to the baby. After a few minutes the uterus would relax and then continue to behave in a more normal manner. We confirmed the observation of Woodbury *et al.* (1938) that excessive response to pitocin could be rapidly inhibited by inhaling amyl nitrite.

More reliable and controlled effects could be obtained by using a dilute intravenous infusion of pitocin. We used 2½ units in 1 pint of 5 per cent glucose solution. The rate of flow could be varied to secure the optimum effect and when the uterine response had been observed there was sometimes advantage in increasing the dose of pitocin to 5 or 10 units per pint. Generally the more dilute solution was effective.

We began to use the drug cautiously in certain patients with hypotonic inertia during the first stage of labour. An infusion containing 1 unit per pint was commenced as a slow drip. The recorded contractions served as a guide to dosage and after some minutes it was sometimes considered wise to increase the strength of the solution to 2½ or 5 units per pint. The record showed exactly what effect was produced and this knowledge protected the foetus from asphyxiating spasm, and the uterus from contractions so violent as to cause rupture.

The intravenous infusion causes an almost immediate effect, but the contractions cease shortly after it is discontinued, although normal labour may follow spontaneously.

We have regarded a pressure of 80 mm. Hg as the maximum permissible at the acme of contraction and any rising of basal intra-uterine pressure above 20 mm. Hg as dangerous to the foetus. Within these limits any effect is comparable to normal first-stage labour, and we do not consider that there is any peculiar pitocin hazard. Although a very small dose usually achieves the optimal effect, one patient, who was quite exceptionally refractory, needed 20 units per pint, and in all was given 60 units of pitocin.

When the uterus contracts strongly the blood-flow through the placenta is impeded and may cease, so that the foetus becomes anoxaemic and may die if the uterus fails to relax. This is a menace, particularly in the second stage of labour.

In the absence of evidence to the contrary we believe that intra-uterine pressures in excess of 80 mm. Hg prevent placental exchange, and clinical observations concerning the development of foetal distress support this opinion. It has been found during the second stage of labour that when the intra-uterine pressure is maintained above 80 mm. Hg for 1 minute in 7, the foetus is not usually embarrassed even if the labour is prolonged for a further 2 or more hours. If, however, the contractions are so frequent and strong that the intra-uterine pressure remains above 80 mm. Hg for 1 minute in 4, then distress may follow quickly. Clearly other factors are involved, and a small senile placenta has notoriously little reserve so that foetal distress may develop in the mildest labour, but generally it is those pressures in excess of 80 mm. Hg which are dangerous if sustained, or if they recur with excessive frequency. Since they are dangerous, excessive contractions are considered to constitute an abnormality of uterine action. It is often urgently necessary, in the interests of both infant and mother, to control them with smooth muscle relaxants, anaesthetics or sedatives, or to deliver the babe promptly.

Summary. The term hypertonic inertia is misleading. It suggests a raised basal intra-uterine pressure. We have found no evidence of this. In such a state the uterus is chiefly remarkable because of its unpredictable and inco-ordinate action.

When used in the treatment of inertia, pitocin should be used in dilute solution. It is wise to start with a drip containing 1 unit in a pint of 5 per cent glucose. Intra-uterine pressures in excess of 80 mm. Hg are dangerous, and if they persist for more than 1 minute in 4 foetal asphyxia usually follows quickly.

Sections from a number of records have been photographed and reproduced. They illustrate the text clearly.

This work has been encouraged by the award of a Leverhulme Research Scholarship by the Royal College of Obstetricians and Gynaecologists, and further investigations are proceeding.

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DR. D. B. STEWART (Aberdeen)

DISORDERED uterine action in labour, otherwise known as uterine dysfunction, is much more common in first than in subsequent labours (Baird, 1952). This communication deals only with labours of primigravidae with single pregnancies in which the foetus has presented by the vertex.

A classification of labour based on clinical observations is described, the essential outline of which is as follows:

(1) *Normal labour*: as arbitrarily defined, ends in spontaneous delivery within 24 hours.

(2) *True difficult labour*. This is classified according to the cause of difficulty into two main groups:

(*a*) the *mechanical group*, in which difficulty results wholly or mainly from disproportion or malposition;

(*b*) the *dysfunction group*, in which difficulty is mainly or entirely due to persistently poor forces or undue soft tissue resistance.

Labours in each group are graded as major or minor according to the degree of difficulty in management.

(3) "*Slow Starters*." This category includes labours which begin ineffectively and last over 24 hours, but later progress normally to spontaneous delivery. These differ in many ways from prolonged labours which are associated with persistent dysfunction. Duration alone is not a good criterion of the efficiency of labour.

The occurrence of difficult labours of the "slow starter", mechanical, and dysfunction types have been studied in the first place among a group of 3,504 consecutive married primigravidae, resident in Aberdeen and booked for confinement in the Aberdeen Maternity Hospital. This group constitutes 85 per cent of married primigravidae in Aberdeen, and the labours of these patients should, therefore, be fairly representative of first labours in general. The only important selection factor is that many patients in the more well-to-do classes are delivered elsewhere.

Analysis of these hospital cases showed that age, duration of pregnancy, and height are each related to the occurrence of difficult labour.

Age. Normal labour occurs in nearly 80 per cent of women under 20 years of age, but in only 32 per cent of those aged 35 or over. Both mechanical difficulty and dysfunction increase progressively with age, but the "slow starter" class does not.

Duration of pregnancy. Seventy-two per cent of labours in the 40th week of pregnancy or earlier are classed as normal; the proportion falls to 61 per cent among labours in the 42nd week or later. Both mechanical difficulty and dysfunction increase steadily with prolongation of pregnancy past the 40th week; the "slow starter" class does not.

Age and duration of pregnancy are not obviously related to each other, and, therefore, they appear to affect the occurrence of difficult labour quite independently. There is no clear evidence as to how this comes about.

It is conceivable that dysfunction may increase with age because the ageing uterus becomes less efficient. Function should logically be better if pregnancy occurs soon after maturity than if the first pregnancy is delayed for many years. Dysfunction may possibly be associated with prolongation of pregnancy, either because uterine efficiency becomes less when the opti-

mum time for labour is past or, more likely, because failure to go into labour at term may be a characteristic of an inefficient uterus. It is important to find out which explanation is correct in order to know whether labour should be induced at term.

The increase in mechanical difficulty with increasing age is less easy to explain. The pelvis does not become smaller with age, and older women do not have much bigger babies than young women. Postmature infants are not noticeably larger or heavier than those born at term, though the skull may be firmer. There is evidence that the rate of growth becomes less during the final stage of gestation (Thomson, 1951). It is suggested that the apparent rise in mechanical difficulty with age, and with prolongation of pregnancy past term, is really due to a lessening of uterine efficiency—not enough to be clinically recognizable as dysfunction, but enough to alter the course of labour when some degree of disproportion has to be overcome. If this interpretation is correct the problem of efficient uterine action takes on a wider significance.

Height. Bernard (1952) has shown that height is a fairly good index of the capacity of the pelvis. Major mechanical difficulty in labour occurs in 7.1 per cent of primigravidae under 5 feet 1 inch in height, but in only 0.5 per cent of those whose height is 5 feet 4 inches or more. Dysfunction is not related to height; it occurs as commonly among tall as among short women.

Any study of the occurrence, causes, or treatment of dysfunction must, if it is to be valid, take into account the variation with parity, age, and duration of pregnancy. The same is true of mechanical difficulty, and here either height or direct measurements of pelvic capacity must be considered as well.

But age and prolongation of pregnancy do not explain all cases of dysfunction. Some young women in labour at term have severe dysfunction, and some older women past term have quick and easy labours. Other factors must also be involved.

It has been suggested that emotional tension and anxiety may contribute to dysfunction. If immediate emotional conflict has this effect, unmarried women and those who conceived before marriage might reasonably be expected to have more abnormal labours than women who conceive after marriage. In fact, among 409 unmarried primigravidae 73.6 per cent of labours were normal; among 734 primigravidae who conceived pre-maritally 74.7 per cent of labours were normal; and among 1,876 primigravidae who conceived after marriage only 63.6 per cent of labours were normal. Both dysfunction and mechanical difficulty were commonest among women who were married before becoming pregnant. These findings must, however, be corrected for differences in age between the three groups. The married group included more older women, and when age is allowed for there is no significant difference in the occurrence of difficult labour between the married, the unmarried, and the pre-marital-conception groups.

It is possible, however, that more fundamental types of emotional disturbance may have some influence upon uterine action. Psychiatric investigation of women who have had severe dysfunction shows that many of them (but by no means all) came into labour in a state of great mental and emotional strain. An investigation of this aspect of the problem is under way, some account of which is given elsewhere (Stewart and Scott, 1952), but it is most difficult to come to any conclusion when efficiency in labour is known to be influenced by the various factors which have been discussed, and also possibly by others which are still unsuspected.

Contracted pelvis has become much less common in recent years and this trend should continue if nutrition improves further. The risks from all types of mechanical difficulty in labour have been lessened as a result of more accurate diagnosis during pregnancy and greater safety in surgical treatment.

Present knowledge only tells us that dysfunction is commonest among elderly primigravidae or in postmature labour. It cannot be predicted or prevented in the individual case until more is known about its fundamental causes. For the same reason the treatment of dysfunction remains unsatisfactory and long difficult labours still occur. In the meantime one must be very sceptical of the value of empirical methods of

prevention and treatment, such as antenatal relaxation programmes, unless they can be proved to have an effect on the outcome of labour independent of the duration of pregnancy, age, parity, pelvic size, and the type of obstetric care. Relaxation exercises may improve a patient's attitude towards labour and add to her comfort, but there is no satisfactory evidence that they have any effect on the efficiency of uterine action.

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DR. L. I. SWAAB (Amsterdam)

I FIRST of all want to thank Professor Bell for his lecture. We so seldom get the opportunity of hearing a physiologist discussing an obstetrical subject that I think we should be glad that we have had the opportunity of hearing him, and I want to ask some questions.

First of all he told us of the big difference between studying uterine activity *in vivo* and *in vitro*. He stated that this difference was so big in nearly all animals, that he preferred to study uterine activity *in vivo*; but he did not give us any reason for this big difference, and I wonder whether he would tell us what it is. I remember that in one of the Swiss medical papers some authors stated that when you studied uterine activity you studied two very different factors. When you study the influence of a drug on uterine activity you study first of all the influence on the vascular system of the uterus, and this vascular factor is just as important as the action on the uterine muscle itself. For instance, when a drug causes an increased contraction of the uterus it also causes uterine ischaemia, and I wonder if the big difference between studying uterine activity *in vivo* and *in vitro* is explained by this vascular factor, which is, of course, so prominent when you study uterine activity *in vivo*.

I would like to ask Professor Bell whether he has investigated this vascular effect and whether he has found it as important as those Swiss authors, whose names I forget, and whether he thinks that this in any way explains the difference between studying uterine activity *in vivo* and *in vitro*.

Secondly I would like to ask Professor Bell whether he has any knowledge concerning a substance called Spasmalgin, about which the French are so very enthusiastic, that they like to use it on every and any occasion. We in Holland, so far as I am aware, do not know very much about this substance.

These are the questions I would like to ask. I should like, in conclusion, to congratulate the Chairman on his exact pronunciation of my name.

PROFESSOR FRANCISCO A. URANGA IMAZ (Buenos Aires)

DURING labour the longitudinal, oblique, and circular muscle fibres of the uterus work in harmony with alternating predominance. The upper and lower segments appear to be mutually antagonistic and the smooth action of the uterus as a whole depends on co-ordination of the motor and inhibitory innervation.

Contraction and muscular tone appear to be excited by different lines of innervation: the former by spinal and the latter by sympathetic nerves.

We have known since Baudelocque (1871) that contraction rings may occur at different heights in the uterus: above or below the presenting part, at the cornu of the uterus, or in the lower segment.

These contraction rings may be an expression of abnormal action of the whole uterine muscle or of isolated portions, functionally dissociated from the rest of the uterus.

The cervix is made up predominantly of circular fibres, and spasm of the cervix may adversely influence contraction of the uterine body, thus reversing the physiological rhythm. The Strasbourg school considers this to be due to dissociation of the sympathetic and parasympathetic nervous action.

They also discount the dilating action of the forewaters, and postulate the existence of diastolic areas appearing after rupture of the membranes.

This is the basis of Kreiss's "medical parturition" consisting of rupture of the membranes and the injection of antispasmodic drugs.

The indications for "medical parturition" are marked sacral and suprapubic pains; spasm of the cervix; spasmodic contractions; hypertonic uterus with poor relaxation; hypotonic uterus; and over-distension.

Originally Spasmalgin alone was used, the dose ranging from 1 to 12 ampoules. Later Spasmalgin was used in combination with oxytocin. More recently, however, we have used Demerol (Pethidine), which we prefer on account of its antispasmodic action, the smaller dosage required, and the negligible action on the foetus.

Our results in 1,531 cases are classified as good, 82.9 per cent; moderate, 9.7 per cent; and poor, 7.4 per cent. Normal delivery occurred in 81.3 per cent of cases. The uncorrected foetal mortality was 1.76 per cent.

DR. G. T. JOHNSON (Newcastle upon Tyne)

AT a previous discussion on disordered uterine function at the Royal Society of Medicine in 1948, Mr. John Hawkins referred to the possible use of caudal anaesthesia in obtaining a better understanding of the nervous control of the cervix without upsetting the detrusor action of the fundus.

During the past 3 years this principle of continuous caudal anaesthesia has been adopted at the Newcastle General Hospital in the management of 58 cases of prolonged labour. By paralysing the autonomic connexions of the cervix it allows fuller play of the fundus with intact connexion upon a relaxed lower segment and pelvic floor. When the duration of the first stage of labour has exceeded 48 hours, either because of established uterine inertia or of cervical dystocia unassociated with cephalopelvic disproportion, continuous caudal anaesthesia extending to the 10th dorsal segment has been induced by the malleable-needle technique.

Cervical dilatation is assessed by vaginal examination before inducing anaesthesia and is repeated after labour has progressed painlessly under its influence for from 4 to 6 hours. In 36 cases complete cervical dilatation was discovered after this time interval and delivery was completed by the forceps. In 16 instances sufficient progress was observed at the second vaginal examination to anticipate delivery after a further period of anaesthesia lasting from 3 to 4 hours. On 6 occasions in this series of 58 patients there was no response to treatment, and lower segment Caesarean section was therefore performed.

Table I shows the results obtained by this method in the small number treated so far, and briefly compares patients treated by other methods in the same department, and at Queen Charlotte's Hospital.

The adoption of this technique in the management of a given case of prolonged labour suggests the following advantages. Firstly, a positive line of treatment is suggested which, if successful, culminates in the delivery of the patient in a shorter space of time than might otherwise be expected. Secondly, there was a higher infant survival rate, despite undoubted

TABLE I

Prolonged Labours, Newcastle General Hospital

Data collected from 6,957 consecutive deliveries, January 1948 to June 1952 inclusive

	Total prolonged labours	Stillbirths and neonatal deaths	Maternal deaths	Average duration of labour
Q.C.H. (Macrae)	638 (3.1 per cent)	77 (12 per cent)	3	74.9 hours
N.G.H. (total cases)	241 (3.4 per cent)	22 (12.9 per cent)	2	66.5 hours
Caudal group	58	1	0	59.0 hours
Non-caudal group	183	21 (11.4 per cent)	2	67.0 hours

evidence of foetal distress in 22 of our cases before anaesthesia was induced. Thirdly, if there is no response to treatment the chances of a successful Caesarean section are in no way jeopardized; indeed, the complete relief of pain resuscitates a tired patient, who is better able to withstand any surgical procedure subsequently found necessary.

Finally, the gravity of the situation we are attempting to treat with continuous caudal anaesthesia appears to outweigh the rare hazards attributed to the method adopted.

Dr. F. E. Lane (New York)

The few observations I have to make are not original, but represent conclusions we have made in America, and in particular at the St. Alban's Naval Hospital in New York.

In defining prolonged labour we have tended to use the 24- rather than the 48-hour period, and we feel that the patient who is allowed to labour for more than 24 hours is generally speaking an obstetrical failure. Perhaps that is too short a time, but we do feel that the differences in foetal mortality and in both maternal morbidity and mortality are so great that no one should be allowed to labour for more than 24 hours if we can prevent it.

We have tried the pitocin drip in the following dilutions: 1:500, 1:1,000, and finally 1:10,000, the latter dilution being used in the induction of labour. We use two flasks and commence the intravenous drip with a 5 per cent solution of glucose, using a large 18-gauge needle in order to prevent coagulation when the drip is slowed. When the drip has been satisfactorily established we switch over to the dilute pitocin solution. We find that labour will commence within 7–10 minutes after the initiation of the pitocin drip. I might add that we do not induce labour for the convenience of the obstetrician. There are some in New York who prefer to keep their week-ends for golf, or fishing, and therefore induce everybody on Thursday or Friday. We reserve induction of labour for what we call obstetrical indications, postmaturity being one of the most important.

The other reason for the use of pitocin is to stimulate unsatisfactory labour—the poor slow contractions and the irregular contractions. Our results have been satisfactory to a large degree. We have had some failures, but greater success has attended the use of the more dilute solution of pitocin. The other thing that I would like to mention is the use of the dilute pitocin drip for postpartum haemorrhage. We have used it with great success in cases of prolonged labour and cases of twins, fibroids, and others in which we might expect postpartum haemorrhage. We find that continuation of the intravenous pitocin solution is a great help in preventing haemorrhage, because it keeps the uterus well contracted, and we have not hesitated to use it for several hours.

Finally a short word of prognostication. I think each one of us likes to prophesy what the future will be. My own feeling in the matter is that obstetrics will soon divide itself into two types of patient—the one who goes to hospital, has a baby quickly and easily, without our help or interference, and the other the Caesarean section. I think when we can differentiate in advance between what is now called difficult obstetrics and easy obstetrics we will then save the woman many many hours and days of work and suffering, and will help our future mothers and future children.

One word regarding Dr. Stewart's remarks about the prolongation of labour in the unmarried. I think his statistics are very interesting, but I do believe his conclusions are absolutely wrong. The unmarried mother is not apprehensive about labour. I have been studying the psychology of labour in trying to determine which ladies should be selected for natural childbirth, childbirth without fear by the Read method. I feel I am bringing coal to Newcastle in talking of natural childbirth in this environment. However, in selecting these women I choose as good candidates the young girls who were taught about menstruation before they menstruated and girls who knew about sex before marriage (I do not mean experience, I mean education). I therefore feel that the young unmarried girl is not the hysterical anxious type, she is merely glad to get it over and I therefore think that Dr. Stewart's conclusions are wrong.

[Dr. Lane later showed a film illustrating natural childbirth.]

PROFESSOR R. CALDEYRO BARCIA
AND
PROFESSOR H. ALVAREZ (Montevideo)

OUR knowledge concerning uterine contractility is still incomplete. In this paper we present some of the facts we have found in the course of our research on this subject. These may serve as a basis to determine the normal characteristics of uterine contractility and ultimately permit a physiological classification of its disturbances. Up to the present, Jeffcoate's (1950) excellent classification of abnormal uterine action is the one which most closely agrees with the results of our research.

Two characteristics of uterine contractility must be borne in mind: (1) the pressure exerted by the uterine muscle on its contents; (2) the co-ordination between the different parts of the uterus.

The *pressure exerted by the uterine muscle* (Fig. 1) is equal to the difference between the abdominal or intraperitoneal pressure and the amniotic or intra-uterine pressure (Alvarez and Caldeyro Barcia, 1950). The abdominal pressure is equal to the vesical pressure, when the contents of the urinary bladder are less than 20 ml. The level of the abdominal pressure is taken as the zero of our scale of pressures. Measured from this zero, the amniotic pressure is equal, at any moment, to the pressure exerted by the uterine muscle on its contents. This method permits a correct measurement of the tonus of the uterus.

Until December 1951 we recorded the amniotic pressure with a mercury manometer connected to the amniotic sac by means of a needle introduced through the abdominal wall (Alvarez and Caldeyro Barcia, 1948). At present (Fig. 4) we introduce into the amniotic cavity a very thin catheter (1 mm. external diameter), flexible but inextensible, connected with a recording electromanometer. This modification reduces the trauma suffered by the patient, and makes records easier to obtain.

We shall now describe the characteristics of uterine contractility studied by recording the amniotic pressure. The *intensity* of each contraction is measured by the increase it causes in this pressure. In normal labours the average intensity of each case ranges between 30 and 50 mm.Hg (Figs. 2 and 5), in some cases reaching up to 60 mm.Hg. If the average intensity of the contractions of a case is below 25 mm.Hg (as in Figs 6, 10 and 14), labour progresses slowly; and it very rarely progresses at all if the average intensity is below 15 mm.Hg (as in Figs. 9 and 17).

The *frequency* of the contractions is generally between 3 and 5 contractions per 10 minutes and we consider 2 and 6 contractions in that time interval as the normal limits of frequency.

The *value* of the uterine contractility in a given period of time is roughly proportional to the product of the intensity and the frequency of the contractions. In the tracing of the amniotic pressure this value is accurately measured by the area included within the elevations caused by the contractions. The higher the value of this area the more rapidly labour progresses, providing no other factors, such as inco-ordination of the contractions, intervene.

We describe *tonus* as the pressure exerted by the uterus between the contractions, and its value in each case is expressed by the average value of all these pressures. In normal labours the tonus ranges between 8 and 12 mm.Hg (Figs. 2 and 5). Higher values are considered as

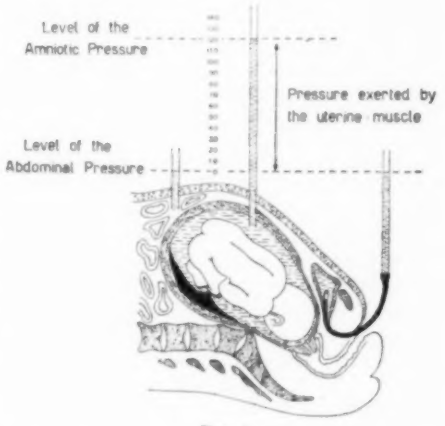


FIG. 1

Basis to determine the pressure exerted by the uterine muscle.

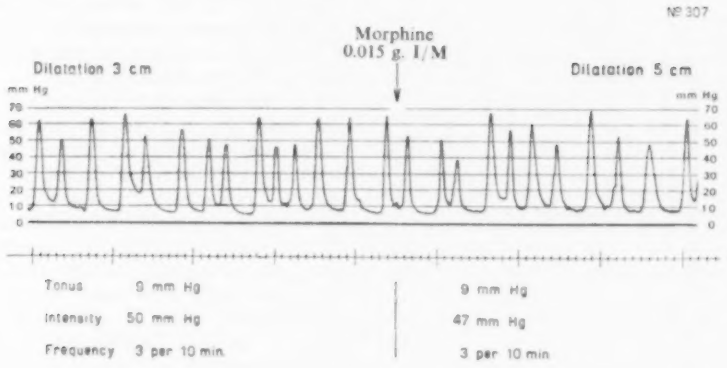


FIG. 2

Record of amniotic pressure in a normal first stage of labour with normal uterine action.

hypertonus and they occur frequently in association with disturbances of uterine contractility (Figs. 16, 17, 18, 19 and 20). Hypertonus diminishes the volume of blood flowing through the uterus, with consequent damage to the uterine muscle and to the foetus. Hypotonus, on the contrary, has been recorded in only a very few cases. In order to measure the tonus correctly it is necessary to have an adequate zero for the scale of pressures (Fig. 1).

In records of the amniotic pressure, normal contractions have a characteristic *form*, which varies with the sensitivity of the recording manometer and the speed of the kymograph. Fig. 2 shows the form of normal contractions recorded with a mercury manometer, the speed of the kymograph being 0.5 cm. per minute. The upstroke is almost straight and vertical, while the downstroke has a hyperbola-like shape. If the following contraction appears quickly, it comes out from the more vertical part of the hyperbola. If the following contraction is delayed, there is time for the more horizontal part of the hyperbola to be traced. It is this last part of the downstroke which, in records obtained by other methods, appears as a straight and horizontal line called "tonus". In the record of amniotic pressure the tonus is reduced to the point of lowest pressure between two contractions. Figs. 14, 16 and 17 show some abnormal forms of the contractions. In Figs. 5, 6 and 7 the speed of the kymograph was 1.5 cm. per minute; the form of the contractions is normal in Fig. 5, and abnormal in Fig. 6.

The records of amniotic pressure obtained by Williams and Stallworthy (1952), using a different method, are, in general, similar to our records. Contractions of a sufficient intensity and frequency are essential for the progress of labour. Something else is, however, necessary, since there may be very strong contractions, which, in spite of their great intensity, are unable to dilate the cervix. For instance, in the case of eclampsia shown in Fig. 3, recorded in the 31st week of pregnancy, there are very strong contractions (average intensity, 86 mm.Hg), twice as strong as those of normal labour. Their frequency is normal. These contractions lasted for several hours without producing any dilatation of the cervix. Further, in the days preceding labour, contractions as strong as those of labour normally occur, but do not produce any cervical dilatation, because there is no adequate co-ordination between the different parts of the uterus. A similar inco-ordination may occur in the third stage of labour. In the majority of cases of placental retention very strong contractions are recorded, which, notwithstanding their intensity, fail to expel the placenta, because they are not co-ordinated (Alvarez and Caldeyro Barcia, 1952).

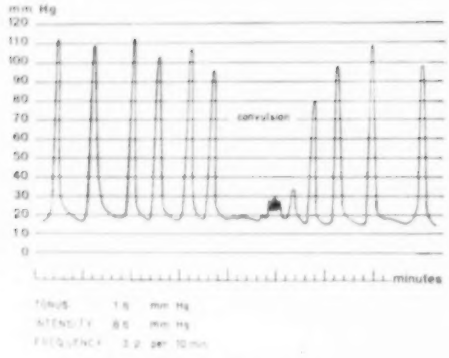


FIG. 3

Record of amniotic pressure in the 31st week of pregnancy in a case of severe eclampsia in coma. The cervix remains closed, in spite of the strong contractions.

Co-ordination of the contractions. The record of the amniotic pressure expresses the activity of the uterus as a whole. To study the co-ordination between the different parts of the uterus, it is necessary to record simultaneously the local contractility of those parts, and observe the intensity and time relation existing between them.

Until December 1951 we used external receptors applied to the abdominal wall to record the local contractility (Caldeyro Barcia, Alvarez, and Reynolds, 1950). With that method we have recorded the activity of 6 or 7 parts simultaneously, using 3 recorders of Reynolds T.K.D. and 4 recorders of our uterine polygraph. The tracings shown in Figs. 8, 9 and 10 have been so obtained.

We now use a new method (Fig. 4) which we believe is much more accurate for recording the local contractility of a given part of the uterus. It consists in recordng the interstitial or intramuscular pressure in that region by means of a very thin catheter (1 mm. external diameter), flexible and inextensible, which is provided at one of its ends with a very tiny rubber balloon. Once it has been introduced into the mass of the uterine muscle, the balloon is filled with a very small amount of water (0.02 ml.). The balloon is compressed by the contractions of the surrounding muscle. An electromanometer, connected with the balloon by means of a catheter, records the pressure of water inside the balloon.

The intramuscular pressure is recorded simultaneously in three different parts of the uterus (for instance, the upper segment, the lower segment and the cervix, as shown in Fig. 4). The amniotic pressure is recorded at the same time by a fourth catheter, without any balloon, introduced into the amniotic cavity. Each catheter is connected with an electromanometer, and each manometer with a recording galvanometer.

Fig. 5 shows a simultaneous record of the amniotic pressure and of the local contractility (intramuscular pressure) of the right and left sides of the fundus uteri. In this case there is very good synchronization between both sides of the uterus. As they contract at the same time, there is a summation of the pressure exerted by each side, and this causes a strong and regular elevation of the amniotic pressure. Both sides relax at the same time, and the amniotic pressure falls to the level of the normal tonus. This good synchronization is characteristic of normal uterine contractility.

Fig. 6 shows a tracing in which both sides contract asynchronically, and each causes an independent increase in the amniotic pressure.

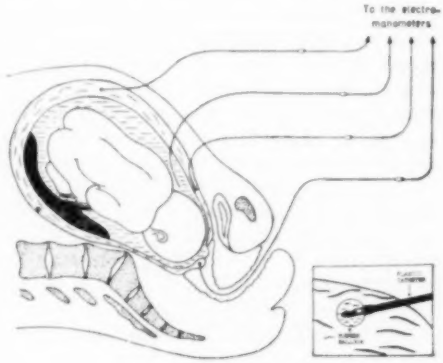


FIG. 4

Method of recording amniotic pressure and simultaneously the intramuscular pressure in the fundus, lower segment and cervix.

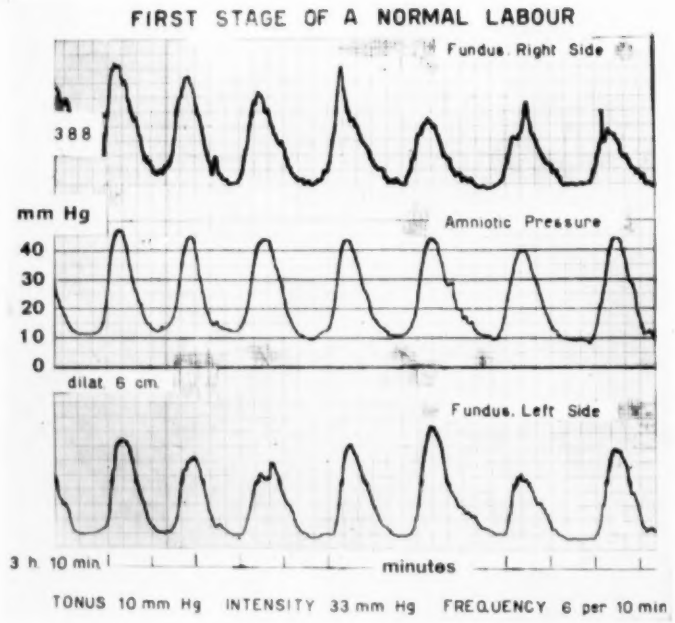


FIG. 5

Simultaneous record of amniotic pressure and of intramuscular pressure in the right side and the left side of the fundus uteri. First stage of a normal labour. Very good synchronization between both sides of the uterus.

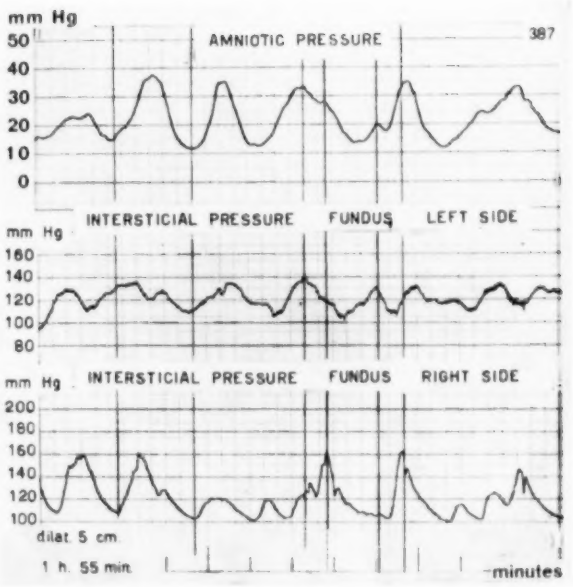


FIG. 6

Same method as in Fig. 5. First stage of labour. Asynchronism between both sides of the uterus.

R.C.B. & H.A.

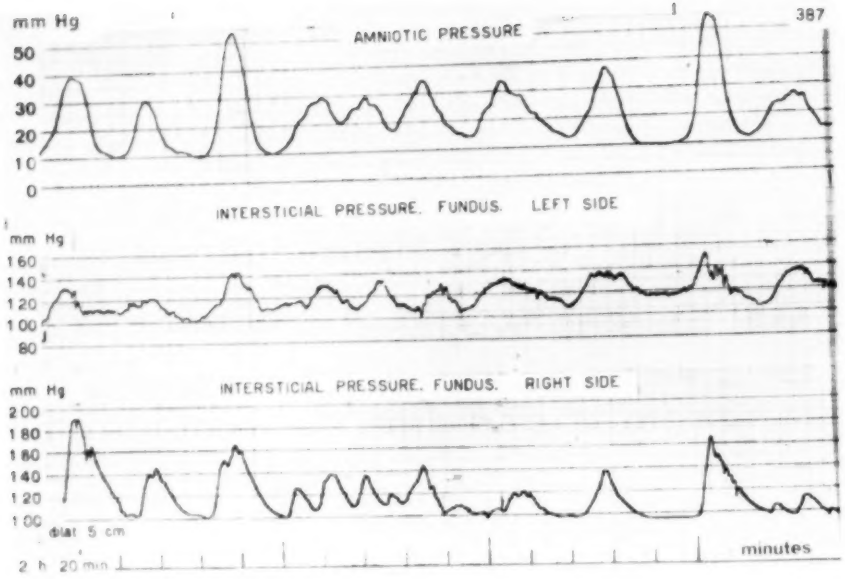


FIG. 7

Same method as in Figs. 5 and 6. First stage of labour of normal progression. A short period of asynchronism (in the midpart of the figure) between two periods of good synchronization.

For this reason the contractions in the amniotic pressure record possess an irregular form. Their intensity, moreover, is lower than normal, because there is not an efficient summation of the pressure exerted by both sides. When both sides relax simultaneously, the amniotic pressure descends to the level of the normal tonus. When only one side relaxes, and the other remains contracted, the amniotic pressure does not descend to the level of the normal tonus, but remains at a higher level. The amniotic pressure at any moment is the resultant of the activity of the different parts of the uterus.

Fig. 7 shows that, when there is good synchronization between both sides (as in the three first contractions), the tracing of the amniotic pressure shows contractions of normal form, high intensity and normal tonus. In the midpart of the tracing, in which there is lack of synchronization between both sides, the amniotic pressure shows irregular contractions of small intensity and high tonus (hypertonus due to the asynchronism?).

In labours which progress normally there is, in general, good synchronization, even though periods of bad synchronization can occur. When bad synchronization is predominant, labours progress slowly or not at all.

Co-ordination between the fundus and the midpart. In normal uterine action there is what Reynolds and his associates (1949) call "fundal dominance", by which they mean that the contractions of the fundus are stronger and last longer than those of the midpart. In the case of normal labour shown in Fig. 8, there is fundal dominance in the right and left sides, and in the midline. Further, there is good synchronization between the fundus and the midpart, and also between both sides of the uterus. The tracing of amniotic pressure has, in general, the characteristics of normal contractility.

Fig. 9 shows the record obtained in a case of false labour, 4 days before the onset of true labour. Contractions of the midpart are stronger than those of the fundus, on both sides and in the midline as well. This is the reverse of the fundal dominance that is seen in normal labour. There is a perfect synchronization between all parts of the uterus. The contractions are of small intensity, causing elevations of only 9 mm.Hg (average) in the amniotic pressure. Because of their slight intensity, and the lack of fundal dominance, these contractions are unable to start labour. These are the characteristics of the normal contractility recorded towards the end of the pregnancy, though in many cases the contractions are stronger than in this record.

In the case of prolonged labour shown in Fig. 10 there is a distinct lack of synchronization between the fundus and the midpart, both in the left and right sides of the uterus. The tracing of the amniotic pressure shows contractions of small intensity (average 15 mm.Hg) which are irregular in their form and rhythm, which is in accord with the asynchronism existing between the fundus and the midpart. Both sides of the fundus contract synchronically. The contractions of the fundus have more influence on the amniotic pressure than those of the midpart.

Co-ordination between the upper segment and the lower segment. Fig. 11 was obtained from a case of prolonged labour associated with contracted pelvis, in which the interstitial pressure was recorded, both in the upper and in the lower segment during Caesarean section. The contractions of the upper segment are stronger than those of the lower segment as occurs in normal uterine action. The majority of the contractions, however, start in the lower segment and spread towards the upper segment, which is the reverse of the pattern seen in normal uterine action. The first contraction of the record starts in the lower segment 22 seconds before that in the upper segment (antiperistaltic contraction?). Only two of the contractions (the 4th and the 7th) start first in the upper segment, and then spread towards the lower segment (normal peristalsis?). The speed of propagation of the wave of contraction is between 1 and 2 cm. per second, since the distance between the two points recorded is 15 cm. The predominance of antiperistaltic contractions may be the cause (or one of the causes) of the very slow progress of this labour.

The tracing shown in Fig. 12 was obtained with the same technique and from a case similar to the one shown in Fig. 11. In this case all

the contractions recorded (23) start in the upper segment, approximately 20 seconds before they occur in the lower segment. Since the distance between the recorded points is 20 cm., the propagation speed is approximately 1 cm. per second. The contractions are strong with good synchronization, and they last longer in the upper than in the lower segment. All these are characteristics of normal uterine action. The only abnormality found, which could explain the slow progress of the cervical dilatation, was that the intensity of the contractions and the tonus are higher in the lower than in the upper segment (hypertonic lower segment?).

Co-ordination between the upper segment and the cervix. The contractility of the cervix and its co-ordination with the rest of the uterus is an important problem which has not, as yet, been entirely solved. Karlson (1949) and Schild, Fitzpatrick, and Nixon (1951) have proved that the cervix of the pregnant human uterus contracts, sometimes co-ordinately with the upper segment, and sometimes independently of it. We have only recently started to study the contractility of the cervix by recording the intramuscular pressure, and notwithstanding our short experience we believe that this method will yield interesting results in the future. Fig. 13 shows a case of prolonged labour in an elderly primipara, in which the intramuscular pressure was recorded both in the upper segment and in the cervix. The upper segment demonstrated very abnormal contractility, with high tonus, weak and irregular contractions, and prolonged spasms, like the one shown in the right half of the tracing. The cervix showed a lower tonus, and some of its contractions are synchronous, and others independent of those of the upper segment.

We shall now study *some patterns of abnor-*

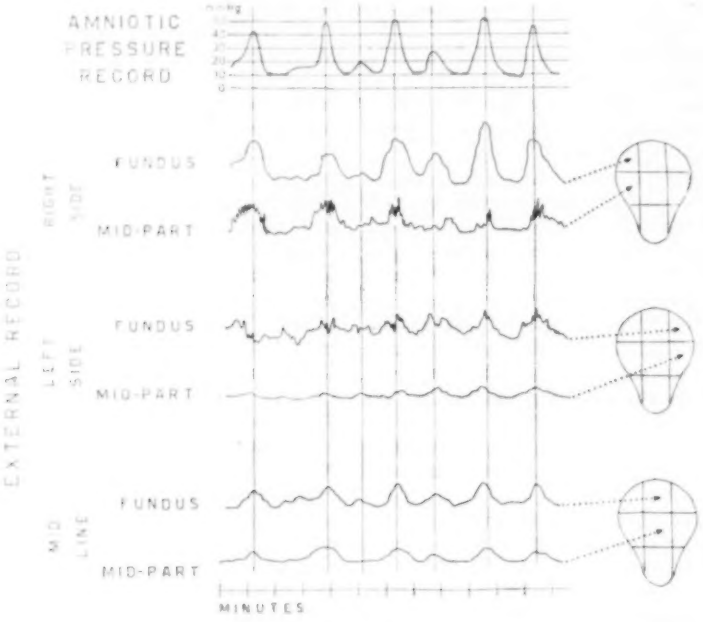


FIG. 8

Normal first stage of labour. Simultaneous record of amniotic pressure, and of local contractility (by external receptors) in 6 different parts of the uterus.

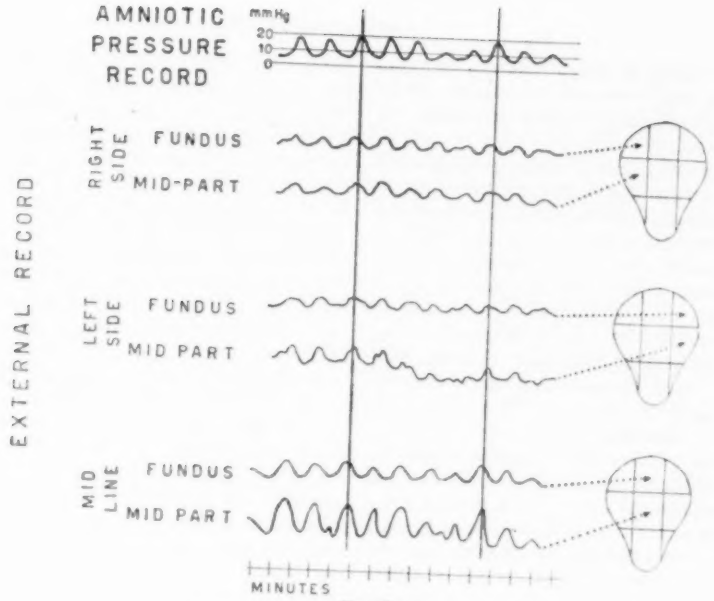


FIG. 9
False labour. Same method as in Fig. 8.

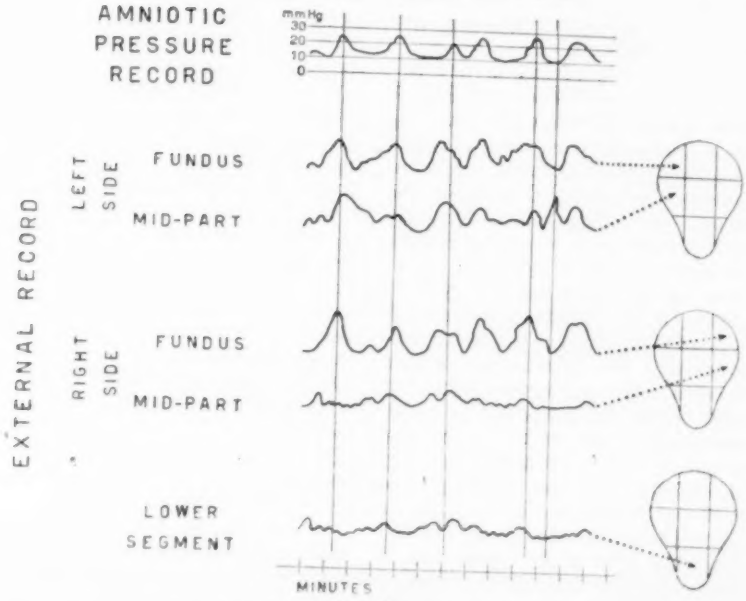


FIG. 10
Prolonged labour. Same method as in Figs. 8 and 9.

mal uterine action in which only the amniotic pressure has been recorded, but which can be interpreted in accordance with the facts described above.

Fig. 15 shows a case of prolonged labour in which the cervix was 4 cm. dilated after 30 hours of labour. This is one of the very few cases of abnormal uterine action that we have recorded which can be considered as true uterine inertia. The uterine contractility is quantitatively reduced without disturbances in its quality, so far as can be detected by the tracing of the amniotic pressure. The contractions are of small intensity (average 10 mm.Hg) but quite regular in rhythm and of normal form. The tonus (5 mm.Hg) is below normal values. This pattern is not very frequently found in abnormal labours. It is very similar to the pattern found in the last days of normal pregnancy, from which it can be distinguished only because in this case the cervix was partially dilated. The injection of Spartein produces a period of hypertonus, and then a distinct increase in the intensity of the contractions and in the speed of dilatation. This action is characteristic of Spartein, which is very useful in this kind of abnormal uterine action.

Fig. 14 shows a pattern which is very frequently found in abnormal labours. The tonus has a normal value (10 mm.Hg). The contractions show a normal frequency, but they are very irregular in rhythm, intensity, and form. The average intensity (16 mm.Hg) is much below normal values. We believe that in this case there must be marked lack of synchronization between the different parts of the uterus. Dilatation in this case progressed very slowly.

Fig. 16 shows another abnormal pattern which is also frequently found. It is a case of prolonged labour with very inco-ordinate uterine action. There is a very high tonus (37 mm.Hg) which causes uterine ischaemia, and in consequence persistent low back pain in the woman, and foetal anoxia. The contractions are very irregular in rhythm, form, and intensity. The frequency (9 per 10 minutes) is much higher than normal. The average intensity (8 mm.Hg) is very low. The form of the contractions is irregular and abnormal. Dilatation progresses very slowly (17 cm. after 30 hours in a multipara). We believe that in this case there must be also a distinct lack of synchronization between the different parts of the uterus, which is the principal cause of the abnormalities that appear in the tracing of the amniotic pressure. But the hypertonus is too high to be caused only by the asynchronism. In certain parts of the tracing the pattern of the contractility changes spontaneously, becoming more normal: the contractions become more regular, stronger, and less frequent, and the tonus decreases. One of these changes coincided with the administration of Spasmalgine, and it is not possible to know if it was spontaneous or caused by the drug.

Fig. 17 shows a case of prolonged labour, with inco-ordinate uterine action. There is hypertonus (18 mm.Hg), and the contractions are of abnormal form, very irregular, and the average intensity (10 mm.Hg) is very low. Dilatation did not progress at all. Spinal anaesthesia was induced with percaine up to the level of the 6th thoracic vertebra. A new record of the amniotic pressure showed that the uterine contractility had now assumed normal characteristics. Contractions were strong, of normal form, regular in rhythm and intensity, and the tonus fell to normal values. The normalization of the contractility may have been due to the spinal anaesthesia, which has proved to be effective in other cases presenting a similar type of abnormal uterine action. A similar normalization of uterine contractility has been produced by hypnotic sleep (Rodriguez Lopez *et al.*, 1950). It would seem that a reduction or suppression of the influence of the nervous system, whether by spinal anaesthesia, hypnotism, or sedatives, tends to improve the pattern of uterine contractility. Adrenaline, on the other hand, causes inhibition and inco-ordination of uterine contractility during labour, as has been proved by Kaiser and Harris (1950).

Seeing that adrenaline is discharged under the influence of the nervous system, it is possible that spinal anaesthesia, hypnotic sleep, sedatives and analgesics might act by reducing or suppressing these discharges.

Up to now we have discussed hypertonus associated with irregular contractions, and we have interpreted it as being caused (totally or in part) by the lack of synchronization in

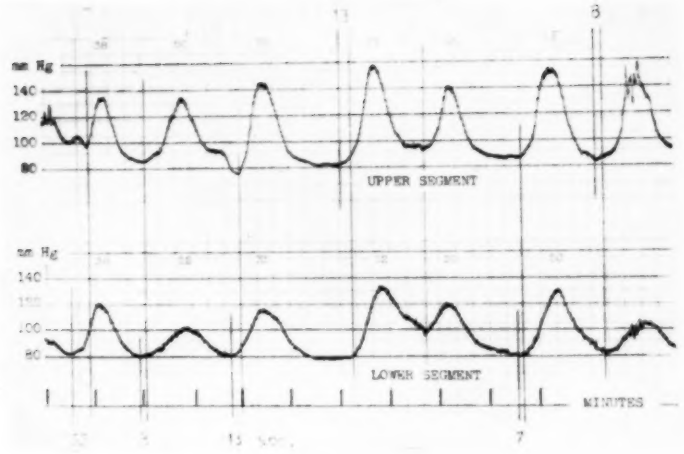


FIG. 11

Prolonged labour in a case of contracted pelvis. Record of intramuscular pressure in upper segment and in lower segment, obtained during Caesarean section.

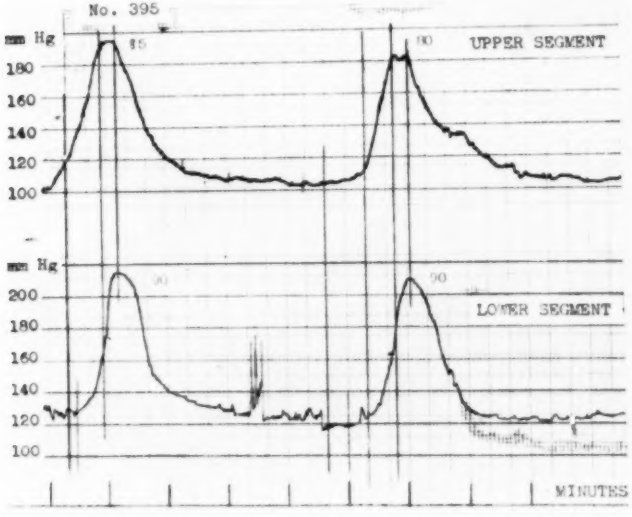


FIG. 12

Prolonged labour in a case of contracted pelvis. Same method of recording as in Fig. 11.

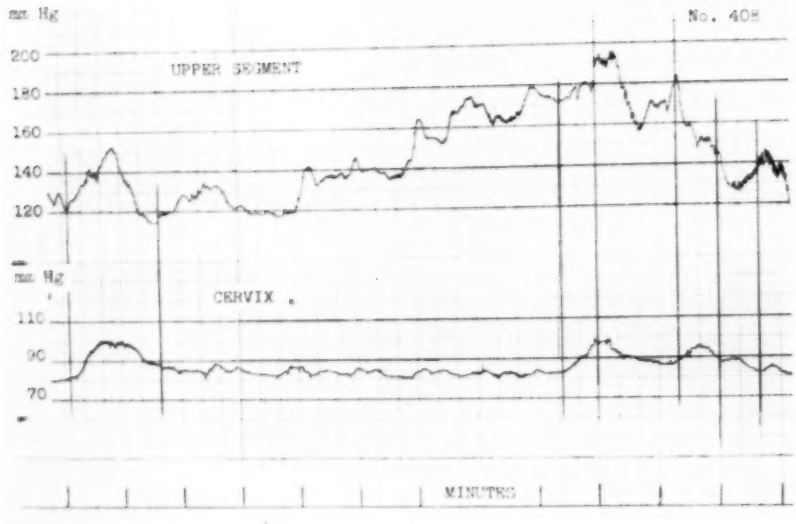


FIG. 13

Prolonged labour in an elderly primipara. Record of intramuscular pressure in the upper segment and in the cervix.

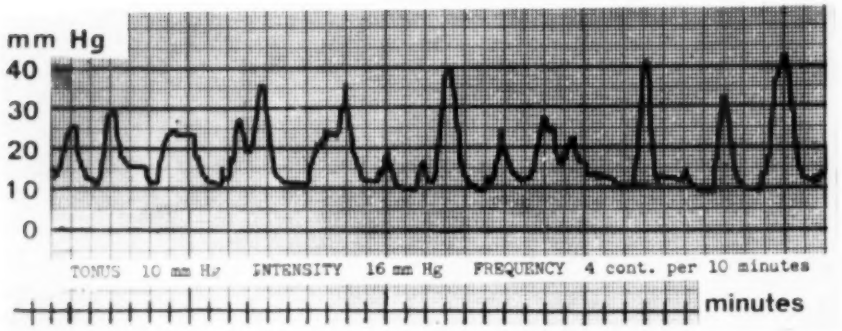


FIG. 14

Record of amniotic pressure in a case of inco-ordinate uterine action with normal tonus.

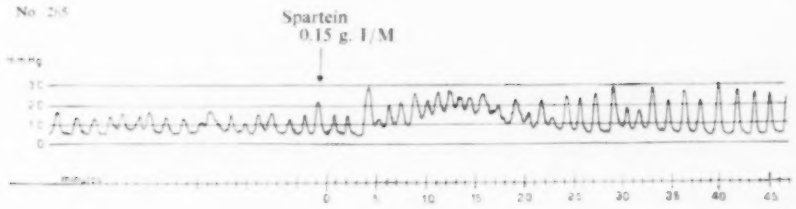


FIG. 15

Record of amniotic pressure in a case of uterine inertia. Action of Spartein.

relaxation between the different parts of the uterus. We shall now see other patterns, in which hypertonus is associated with regular contractions of normal form. Fig. 18 shows a case of prolonged labour (2 cm. dilatation after 36 hours) in a case of hydramnios. There is marked hypertonus (20 mm.Hg) due to the over-distention of the uterus caused by the excess of amniotic fluid. The contractions are of small intensity (average 18 mm.Hg) and low frequency (2 per 10 minutes), but very regular in their rhythm, form, and intensity. Owing to the high tonus, the pain was continuous between the contractions. The withdrawal of 1,100 ml. of amniotic fluid diminished the overstretching of the uterus, and so caused a decrease in the tonus and an increase in the intensity of the contractions (average 33 mm.Hg). Dilatation progressed normally. When the tonus decreased the pain between the contractions disappeared. The withdrawal of excess fluid is the best procedure to decrease the tonus in hydramnios, for neither morphine nor chloroform anaesthesia is capable of modifying it.

Fig. 19 depicts tracings from a case of prolonged labour associated with contracted pelvis. The contractions are quite regular and of normal form. Their average intensity (23 mm.Hg) is slightly lower than normal, and their frequency (8 per 10 minutes) is abnormally high. There is a distinct hypertonus (21 mm.Hg). This is a pattern frequently found in cases in which the uterus has been fighting against a mechanical obstacle for a long time. The artificial rupture of the membranes caused a very small outflow of fluid; the tonus was not modified, but the contractions became stronger and less frequent.

In the two cases of abruptio placentae shown in Fig. 20 there was marked hypertonus (35 and 40 mm.Hg) which must have caused severe uterine ischaemia and consequent damage to the muscle fibres. The frequency of the contractions was normal in both cases. The intensity

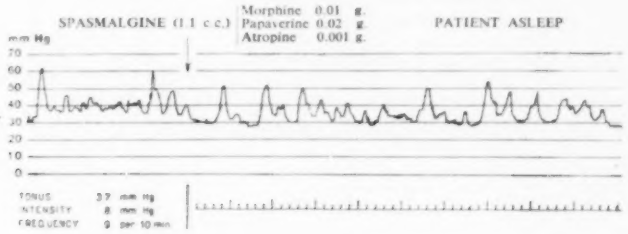


FIG. 16

Record of amniotic pressure in a case of prolonged labour, with very inco-ordinate uterine action, and marked hypertonus. Action of Spasmalgine.

(Continued on page 656

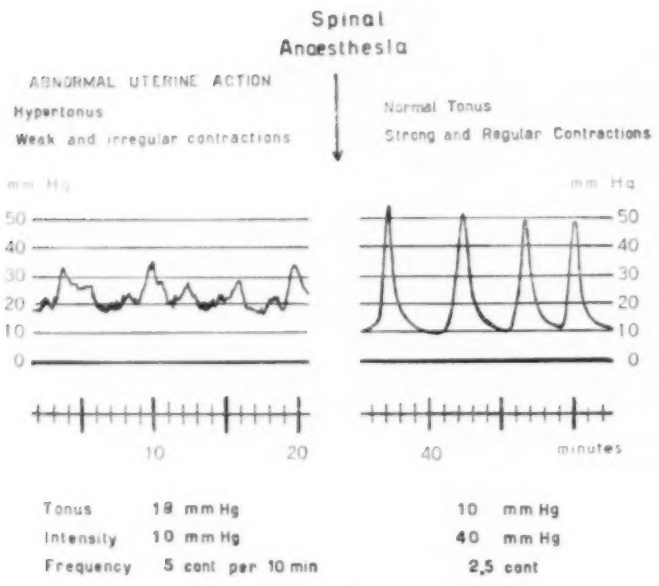


FIG. 17

Record of amniotic pressure in a case of prolonged labour with incoordinate uterine action and hypertonus. Action of spinal anaesthesia.

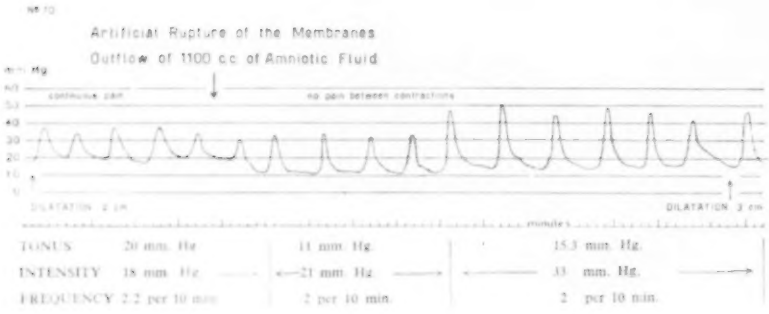

Artificial Rupture of the Membranes
Outflow of 1100 c.c. of Amniotic Fluid
DILATATION 2 cm
DILATATION 3 cm
minutes
TONUS 20 mm. Hg 11 mm. Hg 15.3 mm. Hg.
INTENSITY 18 mm. Hg ←21 mm. Hg 33 mm. Hg.
FREQUENCY 2.2 per 10 min 2 per 10 min 2 per 10 min.

FIG. 18

Record of amniotic pressure, in a case of hydramnios. Prolonged first stage of labour. Hypertonus. Regular contractions. Effect of withdrawal of the excess of amniotic fluid.

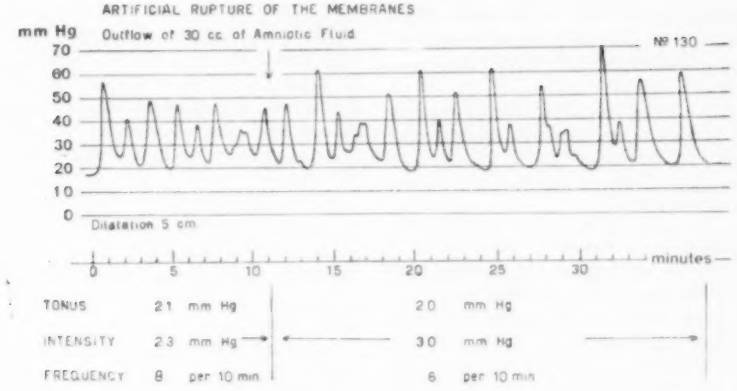
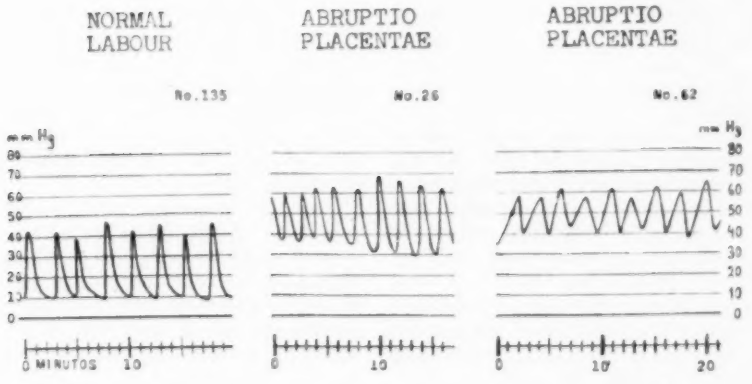


FIG. 19

Record of amniotic pressure in prolonged first stage of labour in a case of contracted pelvis.



Tonus	10 mm. Hg	35 mm. Hg	40 mm. Hg
Intensity	32 mm. Hg	30 mm. Hg	20 mm. Hg
Frequency	4 per 10 min.	5.5 per 10 min.	4.5 per 10 min.

FIG. 20

Record of amniotic pressure in 2 cases of abruptio placentae.

was normal in one (30 mm.Hg) and low in the other (20 mm.Hg). The regularity in the rhythm, frequency, and form of the contractions suggests that there was good synchronization between the different parts of the uterus.

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MISS JEAN HALLUM (Birmingham)

MY excuse for speaking today is in praise of dihydroergotamine, because I feel so strongly that it is a useful drug which is not being utilized to its full in this country. It is not being used properly because it is being tried out in the wrong type of case. In the original article by Soutar he stressed that it would only be of value in uterine dysfunction when the uterine contractions were really strong, but the cervix failed to dilate; in other words, true inco-ordinate action. It is not indicated just because a woman has been in the second stage for so many hours. I have used it in 40 cases having true good uterine contractions in which the cervix had stuck at a dilatation of about 1 or 2 fingers for a matter of at least 6, often over 12 hours. The 40 cases, I may say, were chosen out of 4,000, as it is not a common condition, and the results in half that number were dramatic. The cervix dilated from 1 to 2 fingers to full dilatation in many cases in an hour and practically always within 2 to 3 hours. We only had one failure. Now this is the type of case in which one tends to resort to Caesarean section because the foetus will not stand these strong contractions indefinitely, nor, of course, will the mother. Dihydroergotamine is a completely safe drug. We had only 1 stillbirth out of these 40 cases. I know the number is small. The one stillbirth was due to the cord being tightly around the neck. I do not think you can say it was due to the drug. The dosage used was as originally recommended by Soutar, 0.25mg. intramuscularly, repeating the dose if necessary after one hour. We seldom had to give more than the one injection.

Because of the rapid dilatation of the cervix we naturally wondered whether we would do any harm, but in no case was there a cervical tear. We did not have a single case of post-partum haemorrhage. The second stage was normal, apart from the fact that in 4 cases we hastened delivery with the forceps for foetal distress, but the distress had been present prior to utilizing the drug. I think it may possibly be a useful drug to use if there is slight foetal distress due to strong contractions, as the rapid dilatation of the cervix will enable the second stage to be reached rapidly. No ill effects on the mother were observed and vomiting did not occur. The frequency of the contractions did not alter. The drug did not diminish pain and we used sedatives at the same time.

I said there was only 1 stillbirth. We actually used it in one case where the baby was of less than 28 weeks maturity and it was less than 2 pounds when it was born, so it stuck the drug all right. Analyzing these 40 cases we found that the majority of cases were definitely post-mature. The majority of cases had been induced surgically, but not all, and in some the membranes were still intact when the drug was administered. The presentation varied. We had only 10 cases that were occipito-posterior and in the majority the vertex was low in the pelvis. Age was no particular factor, 3 were under 20 years old, but far more girls than boys were born.

DR. C. N. SMYTH (London)

AS A MEMBER of a team which is working on the problem of prolonged labour I would like to introduce my remarks with a slide showing the distribution of the length of labour against the number of cases. On this graph one can easily plot the average length of labour for the patient whose labour exceeds any chosen duration. For example, at the start any patient may expect to have a labour lasting 15 hours, whereas any patient whose labour lasts for or exceeds 10 hours may expect to belong to a group whose average length is 20 hours, and so on. If, therefore, one subtracts from this curve the length of time already spent in labour you get a graph which gives the average expectation of the duration of labour. You see at the beginning it is 15 hours; after 10 hours, on the average one expects to go another 10; after 20 hours one expects another 12; and over 50 hours one expects on the average another 17 hours in labour.

Now a graph of this character is of very little value in treating the individual case because one's judgment is modified by the knowledge of the rate at which the cervix is dilating, the type of uterine contractions and co-ordination, the size of the baby, and various other factors one has in mind. It would perhaps be an advantage to be able to construct a series of curves of that type covering all possible conditions. One would then be in a better position to decide whether it was necessary to interfere in the course of labour or let it progress normally. Now to construct a further series of curves requires a great deal more information and more precise data-taking than exists in some hospitals. For example, the term labour is used differently in hospitals in different parts of the world. The onset of labour may mean a certain degree of dilatation; it may mean the onset of painful contractions; rupture of the membranes; or even the arrival at the front door of the hospital. The point of my remarks is to make a suggestion that there might be a place for a committee, either international or national, to discuss and recommend what information should be recorded as a routine in cases of labour, including such modern additional information as is available from the use of physiological apparatus, and to arrange for this information to be co-ordinated and readily available.

I would like to say a word or two about another subject, pitocin labours. We have, as have other speakers before me, treated a number of patients with the pitocin drip. In fact in some patients labour was not induced by this technique, for when the drip was discontinued contractions also disappeared. But the two points we would stress are:

(1) It is very desirable to have a careful control at the same time by some form of physiological recording apparatus, as you may get spasm of the uterus.

(2) There is sometimes a considerable delay after the start of the drip before any contractions begin at all, in some cases for as long as half an hour.

The drip is started very gradually, erring on the safe side, and one should not be discouraged because contractions do not begin in the first few minutes. Finally one does see that any pressure on the cervix influences the uterine contractions. If you make a vaginal examination, or rupture the membranes, uterine contractions follow dilatation of the cervix, as Ferguson and others have pointed out. I was interested to notice the same thing in Dr. Williams's slides this morning, where changes of posture caused marked change in uterine rhythm. Is it possible that this change in uterine rhythm was caused by the head being forced lower in the lower uterine segment?

DR. RICHARDSON (Sydney)

Two thoughts came into my mind as I listened to the papers. First, what Professor Nixon said about the psychological effects of labour interested me. Ninety-five per cent of our patients are confined in hospital, and we feel that, with the increasing hospitalization of patients, their attitude to labour is becoming all too much in line with modern civilization, and I do not think this is a very hopeful factor in the prevention and treatment of uterine inco-ordination. The other was occasioned by the remarks of Mr.

Williams from Oxford, when he spoke about posture. The whole idea these days in the hospital treatment of labour seems to be so soon as a woman gets her first pain to call the ambulance, get her into hospital, and put her into bed. We do feel that that is quite wrong, and does upset the essential physiology of labour.

The other thing I wanted to say was what we think in Sydney about dihydroergotamine. I can fully support the remarks that were made by Miss Hallum a few moments ago concerning dihydroergotamine. We find that we must distinguish between inco-ordinate uterine action and just the lazy uterus. You must have the uterus, which has lost its essential physiological polarity, where you are getting contraction and retraction and, above all, localization below. If you pick your cases well you can give this drug with no fear, and it can be given along with appropriate sedatives which do not affect its action, and the results are really remarkable.

During the last year I have used, with increasing confidence, artificial rupture of the membranes, together with the giving of dihydroergotamine where the presentation was favourable and where there was no chance of any further complications. In the last 20 cases that we have done at the Royal Hospital for Women at Sydney, 15 were suitable for artificial rupture of the membranes. We first did it at half-dilatation, but since then we have been doing it when the cervix was a quarter or even less dilated. We feel that the cervix is getting a better *vis a tergo* with the head coming right down on to it, and none of these 15 cases had a labour lasting more than 6 hours after giving dihydroergotamine.

I should like to pay a tribute to Professor Mayes who initiated this study in Sydney, first with Dr. Gill and secondly with Dr. Farrow who is here today, and we do feel that it is worth further trial. We feel that it is superior to the pitocin drip, and one other virtue is that the patient is not worried with apparatus, which may be a cause of further worry to her and may continue the condition which we are trying to cure. We do feel that there is sufficient promise in it for much further investigation, and that it is the most helpful avenue we have found in Sydney whereby this very troublesome condition of prolonged labour can be successfully treated.

PROFESSOR T. N. A. JEFFCOATE (Liverpool)

I WOULD like to emphasize the point made by the last speaker, that it is of the utmost importance to distinguish between the two groups of inefficient uterine action, the one in which it is lazy or weak and the other in which the action is inco-ordinate. I am of the opinion that the lazy type of uterus is a relatively uncommon condition.

With regard to treatment, much has been said today about oxytocic drips. I regard continuous intravenous therapy of great value, not only from the point of view of treatment, but also to enable us to study the effect of different drugs in the human subject. Records have shown that oxytocin only works well in the lazy uterus.

Intravenous therapy of all kinds affords absolute control and safety. If we stop it, the action stops. If we give too much and obtain an unfavourable increase in tone, we reduce the rate of drip and obtain an adequate and normal effect. If we give oxytocin to a uterus which is inco-ordinate the effect is rarely satisfactory. The first slide shows a human uterus contracting irregularly. Pethidine was given intravenously and the irregular contractions were suppressed. The pitocin drip was again started and the last piece of tracing is almost identical with the first. In other words, pitocin will increase the intensity of the contractions, but their character remains the same, and it is therefore of no value in cases of inco-ordinate uterine action.

The next slide illustrates a further point. If you run the pitocin drip for hours the uterus often appears to develop a refractory phase. In this case the pitocin effect lasted for hours until ultimately the effect ceased, in spite of the fact that the rate of the drip was increased to 84 drops a minute.

What can we do for the true inco-ordinate uterus? The next slide shows that, if pethidine be given intravenously in cases of normal labour,

even in sufficient dosage to cause unconsciousness, it will not suppress the normal action of the uterus. The following slide shows that this drug when given in cases of inco-ordinate action of the uterus, may occasionally exert a good effect. The slide shows an inco-ordinate uterus behaving in a very disorderly fashion. The patient was given 400 mg. of pethidine in 7 hours (we have given as much as 800 mg. within 24 hours) through the intravenous drip and the uterus subsequently behaved well. I would not like to say whether this was the result of the pethidine or not, but this drug affords the most perfect rest and at any rate gives time for the uterus to correct its own activity.

Reference has been made to the use of dihydroergotamine. Again I would put in a plea—if you want to try it out, try it intravenously. The slide shows the effect of this drug in a case of inco-ordinate action of the uterus when administered after the patient had been in labour for many hours. There was a slight but doubtful increase in tone, but the contractions became more rapid and did not reach the same amplitude. The ultimate effect on labour was at any rate of no value. The next slide shows another case in which the contractions became more and more frequent, associated with a slight rise in tone. We became anxious about the foetus and stopped the drip.

I am rather ashamed of the next slide as the same sequence of events happened and we lost the baby. I think, however, that the stillbirth was really due to an obstetrical error and not to the drug. Dr. Reynolds of the United States of America has carried out experiments with dihydroergotamine and has come to the same conclusion, that it is potentially dangerous to the foetus.

MR. G. W. THEOBALD (Bradford)

I HAD intended remaining quiet and enjoying the most interesting and instructive papers we have heard today. I do, however, thank you very much, sir, for your kind reference to the fact that we introduced the pituitrin drip, and for inviting me to say a few words.

I agree with much of what Professor Jeffcoate has just said. We have tried several substances in the drip, including procaine, nicotine acid tartrate, dihydroergotamine, and pethidine. We obtained little success with dihydroergotamine and perhaps we ought to try it again. Pethidine we have found most useful and have given as much as 300 mg. in 500 ml. of the drip. The very great difference in the results in the treatment of abnormal uterine action by the pitocin drip obtained by him and by us is probably to be attributed to the fact that we have always, since 1947, freely used morphine, pethidine, and scopolamine in conjunction with the pitocin.

There is just one point I would like to stress. In our original paper we talked about physiological amounts of post-pituitary extract, and not merely a dilute solution of this substance. Everybody seems to have missed that distinction. How is it possible to estimate the physiological amount of the oxytocic principle in the blood? We do not even know that this principle is concerned in normal labour, although it has been stated that animals fail to drop their litters after destruction of the post-pituitary gland.

Our original assumption was that the post-pituitary gland elaborates two substances in equal amounts, the one being anti-diuretic and the other oxytocic. This assumption enabled us to postulate that the effective dilution should lie between 1 : 2,500 and 1 : 10,000, and after 5 years experience in over 200 cases we see no reason to alter our original observations. We have conducted a considerable number of water diuresis experiments using the drip technique in non-pregnant women, in women at term, and in women in labour, and have established the fact that approximately the same order of dilution which inhibits water diuresis also causes uterine contractions.

The only point on which I venture to disagree with Professor Nixon is when he states that the pitocin drip should never be given in cases of contracted pelvis, obstructed labour, or in the presence of any difficulty of any kind. We believe that it is always safe to give a pitocin drip in a dilution not exceeding 1 : 5,000 in all cases in which natural delivery is not contra-indicated, and that dilutions exceeding 1 : 2,500 are neither indicated nor physiologically desirable. The rate of the drip can, of course, be varied from 10 to

60 drops a minute. We use the pitocin in 5 per cent glucose solution which in itself is often of benefit to the patient. We have not lost a baby as the result of this method of treatment for nearly 2 years and have rarely resorted to Caesarean section. We have on a very few occasions dilated the cervix when the head was low in the pelvis, and delivered the infant with the forceps, knowing that the next labour will not be complicated with uterine inertia and that the woman will not be left with a hole in her uterus.

The drip can be safely used without the use of tokographs or any help other than ordinary clinical observation. We have used such instruments and have recorded tracings by the method suggested by Stallworthy and Williams. All such methods are of value in research, but are unnecessary in clinical practice, and tend in and of themselves to cause the condition we are trying to treat.

In conclusion I would stress that we still consider morphine, pethidine, and scopolamine the most important drugs in the treatment of abnormal uterine action during labour and I was delighted to hear this view supported in the outstanding contribution made by Professors Caldeyro Barcia and Alvarez.

MR. D. J. MACRAE (London)

I PROPOSE to show some slides illustrating tocographic tracings in cases of abnormal uterine action during labour. The first shows hypotonic inertia. The contractions are poor, some weaker than others, and their rhythm is irregular; but relaxation between them is complete, so that the foetal circulation is not unduly compressed. This is a common type of inertia in which there is failure of the factors which establish labour, but there is little danger to the foetus and strong labour sometimes supervenes spontaneously. This is the only type of labour in which pituitary extract may be given with relative safety.

The second slide shows a case of poorly established labour with irregular contractions. The foetal head was free at the brim and the cervix 1 finger dilated. One unit of pitocin was injected, and caused regular well-sustained contractions. Labour terminated 12 hours later.

The next slide shows the effect of 1 unit of pitocin injected intramuscularly into a patient who was having painless irregular contractions which were not recognized. The injection provoked irregular uterine action within 10 minutes. They subsequently became regular and the patient was delivered shortly afterwards.

The final slide demonstrates the onset of uterine tetany following the injection of 2 units of pitocin in a primigravida in whom labour had been induced at the 37th week because of intrauterine death of the foetus.

I have seen similar spasm of the uterus caused by an intravenous pituitary drip, but it was more easily controlled. Such is the power of this drug, however, that when I use a pituitary drip I have a Y-piece connected so as to be able to change over to glucose saline as soon as contractions are established.

The other common type of abnormal uterine action in labour is the one in which there is excessive uterine retraction and hypertonicity. This can result from cephalo-pelvic disproportion in which the uterus fails to advance the foetus. Much more dangerous, since it is not recognized so easily, is the condition of non-relaxation of the cervix which I have designated " achalasia of the cervix ". Here the foetal head is commonly engaged in the pelvis and strong contractions are present. The cervix becomes fully taken up but the uterus fails to overcome the resistance of the external os, which remains undilated. The uterine contractions later become spasmodic and irregular with high tone, and the cervix becomes progressively thinned, leaving the external os only 1 or 2 fingers dilated with a thin, knife-like edge. In these cases neither sedation nor continuous caudal anaesthesia has consistently effected cervical relaxation.

Gill and Farrer in Sydney have recently claimed exceptional results in the treatment of this type of case with dihydroergotamine. I have used this drug in the treatment of cervical achalasia and have obtained dramatic results in some cases. Full dilatation of the cervix occurred a few hours after the intramuscular injection of 0.25 mg. of dihydroergotamine and I consider this to represent the first great advance in the treatment of this type of inertia.

PROFESSOR D. BAIRD (Aberdeen)

I WAS very interested in some of those figures from overseas that were given this morning about the large numbers of women, in countries where the standard of living is low, having spontaneous deliveries. There are many factors to be taken into account, but I gathered that one of the important points was the age of the patient.

I do not intend to speak about the treatment of the individual, but the whole problem of difficult labour. Disproportion is less and less frequently encountered and the problem today is the type of labour.

I have put forward a theory that a girl starts menstruating at 14 and by 18, providing she is healthy and fully grown, has reached the best age for childbearing and that labour should then present no difficulty at all. I know that this view may be challenged and I would very much like to have my own observations, and those of my team, repeated elsewhere. If this were accepted as being the case, and I think I could produce a great deal of evidence to support it, the question is why does a primigravida of 28 or 30 have so much trouble, for I am quite certain that she does have more trouble than a primigravida aged 20.

It is agreed that 75 per cent of the primigravidae aged 30 will have no trouble, but 25 per cent of them will have serious trouble. What is the difference in this age group between the 75 per cent and the 25 per cent? We have heard that psychological factors are important. If that be so, what are the psychological factors which are concerned, if any? Or is it simply a question of differing ageing of the uterus? Do some women's bodies, uterus and ovaries and all the structures, age more quickly than others? We know that some women of 30 will have endometriosis and fibroids in the uterus.

We must really try and tackle this problem of psychological factors much more scientifically than we have done in the past. It may be that a girl who marries at 18 has a one-track mind concerned solely with reproduction and nothing else and be working from the medulla downwards. It may be that the woman of 30 who is having her first baby has taken first-class honours in classics or medicine and is really wondering whether she should give up this career for some male who is not particularly perfect, and who is not perhaps as intelligent as she is herself. She must be suffering from a great deal of mental anxiety and has not got her mind on the work, that is to say having a baby.

This is a disease of civilization, if we call what we are living in now civilization. It is either purely a question of ageing or a question of ageing plus all those complicated psychological factors we have in modern life, and if so I do not see how the complicated aetiology can be unravelled. If this concept be valid it is very difficult to measure the effects of any endocrine or vitamin—or anything else—or say this or that is the important factor.

What you do about it is, of course, another matter. It may be that all those drugs are important; it may be that psychology is important; I do not think we know. I would, however, put forward a plea for someone to confirm my hairbrained belief that age is the fundamental factor of all. If this be true, the question is at what age do different women age mentally as well as physically. I do not mean to decry the interesting and painstaking observations on uterine action or any other piece of research, but I do feel that the broad basic biological principles have been rather neglected.

CHAIRMAN'S REMARKS

PROFESSOR CHASSAR MOIR (Oxford)

I BELIEVE it is the Chairman's privilege to attempt to sum up the discussion, but I confess that this task is quite beyond my ability, because it has ranged over such an enormous field. It is remarkable how much has been accomplished in this field since this recording of uterine activity started more than 60 years ago with Schacht's intra-uterine bag. Very little more was done on this subject until Burn and Bourne produced an excellent piece of work which has been quoted today.

In recent years much detailed work has been done and we owe a debt of gratitude to the physiologists who have helped us so much, and to Professor Bell who has put some very interesting points before us this morning. Much of the advance in recent years has been due to the co-operation with physiologists and in particular to the excellent work done in Montevideo by the combined team of physiologists and obstetricians.

Excellent work has been done by other people and by Mr. Williams, who, by the simple method of introducing polythene tubing into the amniotic sac, has produced some very excellent records of patients in labour. I should like to mention that we owe a great debt to Mr. Theobald who was the man (I think I am right in saying this) who first proved the practicability of giving pituitrin by the drip method.

I am now going to make one or two remarks of my own. I do feel that someone ought to say that two things proposed today are potentially dangerous. One is the administration of dihydroergotamine which, if a very small dosage is exceeded, may produce very strong and incessant contractions leading to death of the foetus and possibly, in extreme cases, rupture of the uterus. The trouble is that once a new drug is introduced into a hospital it is so apt to be administered by registrars and housemen, often with little understanding of the real and inherent dangers.

It is perhaps unnecessary to point out that dihydroergotamine is a modification of the molecule of ergotamine tartrate which has been used for many years and, because of the tremendous spasm it causes, is too dangerous to administer during labour. This new modification is supposed to have altered its pharmacological properties—and no doubt it has—but I am going to make a rash guess which may prove unfounded. I just wonder whether there may not be a tendency for this substance, when kept in an ampoule, to revert to the parent form, and this change might explain the dangerous uterine spasm which has sometimes occurred when this drug is used. I certainly know from my own experience that 0.25 mg. dihydroergotamine has produced extremely dangerous effects.

The same danger is present with pitocin and a slightly increased concentration, or an increased rate of flow of the drip, may produce a marked spasm of the uterus. I think it is Professor Eastman, of the Johns Hopkins Hospital, who has written about the potential dangers of this method as well as its advantages.

Another point: one or two of the speakers implied, or actually stated, that there was no such thing as hypotonic inertia. I think one speaker put it the other way round and said there was no evidence of hypertonic inertia. Would it perhaps be better that both those terms should be abolished and that inco-ordinate action be substituted for at least one of the types, perhaps the hypertonic type?

Lastly, for I am not here to speak in this discussion except to wind it up, I would just like to make a plea for a very elementary point in obstetrics. I am convinced that many patients start labour slowly and ineffectively because the head is not engaging comfortably in the pelvic brim and that the primary fault is a high head. This is perhaps caused by some pelvic abnormality or a big head: perhaps it is in the wrong position—occipito-posterior, maybe—but the inertia is not the primary thing; the primary thing is the obstetrical abnormality. We should always beware of abnormal cephalo-pelvic relationship or the abnormal engagement of the head in the brim, and not go chasing after inertias which may be just a manifestation of cephalo-pelvic disproportion.

THE PLACE OF THE PAEDIATRICIAN IN A MATERNITY UNIT

OPENING PAPERS

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PAEDIATRICS involves the care and treatment of infants and children; the treatment may be either prophylactic or therapeutic. The age at which a child ceases to be acceptable for care by a paediatrician is of small moment—it may be 14 years or 16 years, or it may be related to puberty or adolescence. In contrast, the age at which an infant should first receive paediatric care is of the greatest moment and this is a matter in which obstetricians are intimately concerned.

Taking an extreme view an infant may be considered to be "paediatric" when the obstetrician discharges the mother at the end of her puerperium. In such circumstances a paediatrician will only be asked into the maternity unit if the obstetrician is worried about an infant's condition during the first 2 weeks of life. If this view be upheld, then there is virtually no place for a paediatrician in a maternity unit, for, unless the paediatrician can himself have adequate experience in the care of normal infants, he will be at a disadvantage in treating sick infants owing to lack of appreciation of the extent to which they differ from normal and the variations which may still be regarded as physiological. Nor will he have learned to recognize the earliest changes produced by infection, dehydration, and nutritional upsets which might in these stages rapidly respond to appropriate therapy given promptly.

Taking a less extreme view an infant might become eligible as soon as he leaves the labour ward. This would mean that any immediate resuscitation manoeuvres were performed by the obstetrician who would, therefore, have to divide his attention between the mother and the infant. The paediatrician would subsequently take over the responsibility for all the infants in the unit.

A broader view would include the paediatrician's attendance in the labour ward when required, to undertake the care of the infants and to resuscitate them if necessary. In Caesarean section, for example, or when a difficult delivery is anticipated, immediate skilled paediatric care would be available. Similarly, when premature babies, or babies likely to be affected by haemolytic disease are expected, or when a diabetic mother is being delivered, the infants may need urgent and special attention.

There is, however, an altogether wider outlook possible, namely that birth is only an incident in a baby's life and that much more important happenings have been occurring during the preceding 9 months which are of the greatest paediatric interest and concern. A knowledge and understanding of these happenings may materially affect the immediate postnatal picture and, unless the paediatrician has access to this knowledge, he may not be able to give the best possible advice about the care of the infant in the neonatal period.

The late Sir Leonard Parsons, the first paediatrician to be honoured by election to the Fellowship of the Royal College of Obstetricians and Gynaecologists, took as his subject for his Blair Bell lecture "Antenatal Paediatrics", and anyone who reads this paper (Parsons, 1946) will appreciate the implications of antenatal care, both from the paediatrician's viewpoint and from a consideration of the future of the child. Further progress in promoting child health is most likely to come from active research in this field as a joint project planned between obstetricians and paediatricians. For example, pre-

maturity is the chief cause of neonatal mortality today. It is thus a matter of urgency, both obstetric and paediatric, that its aetiology should be understood so that steps may be taken to prevent or minimize its occurrence. The cause is known in less than 50 per cent of cases. Apart from plural births the commonest known predisposing condition is toxaemia of pregnancy. The prevention and treatment of this condition are thus matters of paediatric concern as well as being outstanding obstetric problems. Until they are solved the obstetrician's first duty must be the mother, and this unfortunately often involves the untimely death of the foetus or the birth of an infant so premature that, if he is to survive, the nurse's and paediatrician's skill will be taxed to the utmost.

At first sight it might seem strange that paediatricians should be interested in the first trimester of pregnancy, particularly with regard to the mother's diet and her exposure to various infections, yet a fuller knowledge of the happenings at this vital period of foetal development offers the best hope of reducing the incidence of environmentally determined congenital abnormalities. There has been such an improvement in obstetric skill in the past 20 years that not only has maternal mortality been reduced to such a degree that any death in a maternity unit is now an extremely rare occurrence, but birth trauma also has greatly diminished as a causative factor in neonatal deaths. Paediatric care has, to a less extent, reduced the death rate from infections in the newborn period and, as a result, congenital anomalies have now assumed a greater significance and are today the third commonest cause of neonatal deaths, besides causing many abortions and stillbirths. Establishment of the fact that environmental as well as genetic causes of congenital abnormalities existed was due, not to an obstetrician nor a paediatrician, but to an ophthalmologist. Further research should not, therefore, be limited to obstetricians, but should be conducted by a team of workers of which paediatricians should certainly be members.

Only about 10 per cent of all deaths occurring between the period of viability and the end of the neonatal period are " paediatric " deaths; the remainder are due to antenatal and paranatal conditions which the paediatrician is powerless to control or modify. Paediatric participation in antenatal research and in assessing the effects of various obstetric manoeuvres (such as Caesarean section; forceps deliveries; length of time between rupture of the membranes and delivery, and the relation of this time to the incidence of infections; the time of clamping the cord in relation to the subsequent blood volume in premature infants and to reduction of haemolysis in infants with congenital haemolytic disease; and the effects on the foetus of maternal anaesthesia and narcosis) may help in shedding light on new methods of lessening this loss of foetal and neonatal life.

Obstetricians are naturally concerned about the subsequent well-being of the infants they have delivered. This involves their ensuring to the best of their ability that mothers are going to feed their babies at the breast, and for this the mothers must certainly be prepared—both psychologically and physically if necessary—in the antenatal period. Breast feeding is undoubtedly one of the cornerstones on which child health is built. There are many reasons why breast feeding may fail, and some why a decision to resort to artificial feeding is already made before the infant is born. Fear of failure, perhaps because of failure with a previous infant, apathy, misinformation, and ignorance may all lead a mother to ask that her infant may be fed artificially. Appropriate instruction and encouragement would, however, permit the majority of these mothers to feed their infants successfully on the breast. In the case of physical difficulties such as retracted nipples, antenatal treatment may succeed in restoring normal conditions. If advice and treatment are not given by the obstetrician, they might be considered as a legitimate part of the antenatal paediatric programme.

The decline in breast feeding which is occurring in the community today must be regarded as being due, at least in some measure, to neglect of encouragement and guidance and of adequate antenatal care. There are certain conditions in which it is undesirable (and in some cases dangerous) for a mother to feed her baby, and the obstetrician rightly bans breast feeding; but these make up a very small propor-

tion of all those mothers who do not feed their babies. Intelligent propaganda and a real keenness on the part of obstetricians, exhibited early in the antenatal period and maintained steadily throughout pregnancy, would go far towards reinstating breast feeding. Such a state could be achieved, for example, by the appointment of a paediatric sister or some trained person to attend the antenatal clinics and to see and talk to the mothers, advising and treating where necessary those in whom the obstetrician finds no contra-indication to their suckling their infants.

After the birth of the infant the care of the breasts becomes the joint responsibility of obstetrician and paediatrician.

There are two stages in particular when, in practice, breast feeding is found to fail: the first when the milk is just coming in on the 3rd or 4th day and the breasts are engorged and very painful; and the second when the mother starts her household duties again, usually between the 10th and 14th days. In view of the fact that at the first stage the mother is under the care of the obstetrician and at the second she is in a " no-man's land " having been discharged by the obstetrician and not yet visited by the health visitor, and that both stages are of paediatric interest because they may determine the future feeding of the infant, it might be well if they were both recognized as paediatric and the paediatrician held responsible. An even more convincing argument in favour of this is provided by the good results obtained by Waller who has shown how care and simple preparation of the breasts in the antenatal period have increased the incidence of successful breast feeding.

In those maternity units where paediatricians play their appropriate part the obstetrician has, in addition to being relieved of the worry of resuscitating anoxic infants, been spared the task of diagnosing and arranging for the surgical treatment of all the congenital anomalies amenable to surgery in the neonatal period. He has seen much greater care taken in the prevention of infections, both major and minor, in the infants and also in the nurseries. He has seen the mortality rate among premature infants and among infants suffering from haemolytic disease fall appreciably. He has been able to order suppression of lactation when it is imperative, either temporarily or completely, without further worrying about the infant's nutrition, secure in the knowledge that his paediatric colleague will be able to order a feeding formula which, while inferior to that resulting from breast feeding, will still be suitable for the particular infant. Finally, he knows that because the paediatrician is caring for all the infants, well and ill, normal and abnormal alike, he will be able to rely on his experience of normal infants to enable him to detect the earliest signs of abnormality, disease, or infection and to start treatment, either prophylactic or therapeutic, at the first possible moment.

To sum up, the duties of a paediatrician in a maternity unit will first and foremost be the care of the infants during their stay in the unit. This care will include attending in the labour ward or theatre on the request of the obstetrician at the delivery of any infant likely to require resuscitation or special care. The control of the nurseries, both administrative and clinical, in those units where there are separate nurseries, should be in the hands of the paediatrician. Where the mothers and infants are nursed together he should be responsible for ordering and arranging for the transfer or segregation of infants when necessary. Where problems concerning breast feeding arise there should be consultation between the obstetrician and paediatrician to decide on the best procedure to be adopted. Retracted nipples, engorgement of the breasts, or early signs of mastitis, all affect the infant's well-being as much as they do the mother's. It is difficult to lay down rules for temporary weaning, manual expression or the use of a breast pump, the prescribing of stilboestrol or some other suppressant, which can be applicable routinely in given circumstances. Each case must be considered individually, and it is best, both for the mother and the infant, if such consideration can be made jointly by the obstetrician and the paediatrician.

An important duty of the paediatrician is to institute a follow-up of the infants to consider their subsequent progress, particularly with reference to any special features connected with their antenatal history, delivery, or neonatal period. It is only by such a follow-up that the

obstetrician can learn of the success or otherwise of any special techniques he has evolved in the conduct of deliveries in particular types of case or in comparing the results of two different methods.

The training of medical students and post-graduates (in a University unit) in the principles and practice of neonatal physiology and pathology, and the instruction of midwives in the care of the newborn and in the prevention of infection, are essential parts of the paediatrician's duty. It is as important for the obstetric resident to go round with the paediatrician in order to learn how to care for the infants as it is for the paediatric resident to go round with the obstetrician to learn the details responsible for the particular method of delivery undertaken. Research in the problems of the newborn is another duty and one which may well be the subject of joint deliberations with the obstetrician.

It will be obvious from the foregoing that frequent meetings between the various members of a maternity unit are essential. Midwives and nursery sisters should have free access to regular joint discussions. At these meetings neonatal deaths need not be the sole topic of conversation; policy, administration and methods of treatment may be considered. The atmosphere necessary for the ideal unit can obviously only be provided if obstetrician and paediatrician are alike alive to the needs of their respective charges and are also mutually sympathetic one to the other; they should be, in fact, as much a single unit as are a mother and her infant.

The maternity unit is under the direction of the obstetrician who, acting as *primus inter pares*, delegates all aspects of the care of the infants to his paediatric colleague.

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2. FRANCIS E. STABLER, M.D., F.R.C.S., F.R.C.O.G.

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I WAS surprised and not a little dismayed by the subject chosen for this meeting. Not only did I think it a sterile subject—that there was nothing to talk about and no room for discussion—but also it seemed to me that it was invidious and even impudent for me to discuss the place of a medical colleague. The reason for my thinking that this subject was sterile and would not provoke any discussion was that at the Princess Mary Maternity Hospital in Newcastle upon Tyne it was disposed of many years ago and now never enters our heads. We have no defined status for our paediatricians: the whole hospital is theirs—wards, labour rooms, theatres, and nurseries. We obstetricians have no defined status: the whole hospital is ours—wards, labour rooms, theatres, and nurseries. We get along with our paediatrician colleagues in the greatest friendliness. We can argue with them, contradict them, and even be rude to each other without arousing any resentment. So in my ignorance I thought I would be flogging a long-dead horse. My first eye-opener came when interviewing candidates for an obstetric post. They were asked for their opinion on this very question and I noted three of their answers.

One man said that his knowledge of paediatrics was limited because there were paediatricians in the hospital where he worked. (He was not an Irishman.)

The next man thought that paediatricians should take over one hour after the birth of the child.

The third would " hand over sick and premature babies to the paediatricians."

Now I have never "handed over" a patient in my life. Infants and adults remain just as much my patients though I have a colleague helping in their management and even though he may play a major part in their care. I am still as interested and still as attentive as if I were conducting the whole care. The answers of these three men set me making inquiries and I

found that there are still many hospitals in the same state that we were 20 years ago. I had then just been appointed to the staff of the maternity hospital, and I attended staff meetings. I remember an occasion when the paediatrician was unable to attend one of these meetings, and we seized the opportunity to discuss and define his province. Our conclusion was that he should be responsible for all premature babies and all babies who were sick after the first 12 hours of life. The paediatrician was kept in his place and that place was the abnormal baby. This deplorable attempt to limit the field of action of a friend and colleague seems to me now a relic of the Dark Ages.

Let us start from this 12-hours limit and try to decide just when the paediatrician should become interested in the welfare of his patient. To debar him from the first 12 hours means that he is debarred from full knowledge of the most important 12 hours in that baby's life. In the progress of a human being from birth to death there is a constant deceleration. We talk of old age and middle age, for it is of small moment whether a man is 45 or 49. We talk of being "in the twenties." Decades count. We talk of a child being 6 or 7 years old. But when we come to talk of the newborn baby we speak of it being so many hours or even minutes old, for at that time events may happen and changes take place swiftly. Surely if we want good work from our paediatrician, if he is to become skilled at his job, he must be there to observe and help with the baby from the moment of birth. Moreover he must be at our side for all babies, sick or well, premature or mature. To send for him only for such babies as are damaged, asphyxiated, infected, or premature in birth would be like restricting an obstetrician to abnormal cases only. Without a sound experience of the physiological process his management of the pathological would suffer.

But if we seek the aid of our paediatrician colleague for all babies from birth onwards we have still not done enough. The paediatrician wants to know *why* this baby has some cerebral trauma, *why* labour was induced and produced a premature infant, *why* the liquor amnii became infected and so infected the baby. He is, therefore, concerned with his patient during labour. He thereby learns to assess what effect normal and abnormal labour and delivery are likely to have on the child. Breech delivery or forceps delivery must mean more to him than a mere notation on a chart and so he learns and understands a great deal of our problems in the management of labour.

I would go further. He is concerned with the health of the foetus *in utero*. The preparation of the mother and of her breasts for lactation are important paediatric considerations. Quite apart from the effect on his future patient of maternal diet and hygiene there are problems, such as rhesus incompatibility and maternal virus infections, which are of vital importance to the baby. He is even concerned with the health of a married couple before conception.

We therefore hope and expect to have the help of our paediatrician colleagues (and this includes sisters and nurses) in the antenatal department, in the antenatal wards, in the labour rooms, in the theatre, and in the lying-in wards. It is a fact that when a paediatric registrar leaves the hospital he is a very good obstetrician and it is very needful that he should be so for him to be of service to his patients, the mother and child. I think I can claim also that by the time an obstetric registrar leaves he at any rate has had the opportunity of becoming a very sound paediatrician so far as the newborn baby is concerned.

Here I would like to digress. We are faced with the problem of what is a paediatrician? How is he defined? So far as external markings go one cannot tell a paediatrician from a geriatrician. There is no college of paediatricians and no examination in paediatrics. Very wisely, I think, they have decided not to seek such external evidence of their particular interest. I found one answer to the question in a recent leading article in the *British Medical Journal* (27th October, 1951, p. 1016). Paediatrics is defined as "general medicine in the younger age groups". What a monstrous thing! I think of a picture that hung in my bedroom when I was a small boy. It was a beautiful picture but the caption under it did not read "Suffer the younger age groups to come unto Me and forbid them not." What the writer of

that leading article meant and what the editor should have seen that he wrote was " paediatrics is defined as general medicine in little children." Our ideal paediatrician must have a broad base to his experience of general medicine, and included in that base should be at least a year of general practice. In paediatrics, even more than in obstetrics, it is essential for the physician to know the whole environment and mode of living of his patients, and to learn that he must live with them and know their problems apart from those that bear directly on sickness and health. We hope then that we have a man with a wide basic knowledge and experience of general medicine who has inclined towards the management of little children. I asked Sir James Spence to tell me " What is a paediatrician? " The only definition I could get was " He is a good doctor ". That is a good enough definition for me and means a great deal more than that he is a member of the Royal College of Paediatricians. Which of us would not welcome a good doctor by our side at all stages of childbirth, be he paediatrician, physician, anaesthetist, pathologist, or what you will?

Now where does he stand in the staff of a maternity hospital? He should have full equal status with his obstetric colleagues. He should be on the Staff Committee, for we need his help in designing or altering the building, the equipment, and the mode of work. He should be free to enter any department of the hospital, antenatal, postnatal, and labour wards. To understand his subject he must have a close knowledge of events in all these departments. All the babies in the hospital must be his concern before, during, and after their birth. Indeed he must be an obstetrician. It is not necessary for him to acquire the manipulative skill demanded by obstetric diagnosis and treatment, but he must be fully conversant with the problems of long labour, haemorrhages, toxaemia, and concomitant maternal disease. The training of any paediatrician is incomplete without a full knowledge of all that goes on, physiological and pathological, from conception until the baby becomes his more direct concern. We obstetricians must welcome by our side this " good doctor " at all phases of childbirth.

To deserve this wide conception of his province the paediatrician must accept the demands that all obstetricians accept. He must take some part in antenatal care. He must be prepared to follow the course of labour and he must be prepared to get out of bed to attend all Caesarean sections, all premature births, all forceps deliveries, all abnormal deliveries, and a good number of normal deliveries. He must be on hand to guide normal and abnormal mothers and babies in the wards after delivery, and he must follow the progress of mother and baby after they leave hospital. He must not shut himself up with his premature and ill babies in a department with NO ADMITTANCE on the door. He must be seen frequently and daily in the wards, labour wards, and theatre.

You may say that this is handing over with a vengeance—that all except the mere mechanical removal of the child from its mother has been transferred to the paediatrician. As I said before, I have never handed over a patient in my life, even when the condition has been beyond my province or my competence. We as obstetricians must be prepared to take just as much interest in the baby as though there were no " good doctor " colleagues. As often as we visit the premature baby's mother we must visit her baby, and the obstetrician must be seen as frequently in the premature and sick baby unit as he in the lying-in wards. We must avoid any question of " taking over " of our patient or our responsibility. How are we to avoid the difficulties of dual control and accusations of one interfering with the province of the other? There is only one way and it is not by laying down rules and restrictive regulations. It is by close personal contact between the two at all phases. Frequent clinical and social contact will break down any barriers of hostility or jealousy. When the obstetrician freely discusses obstetrics with the paediatrician, and the latter as freely discusses his subject with the former, it will soon be found that the margin for disagreement is so small as to be negligible.

So we come down to the brass tacks of the position and duties of the paediatrician in the maternity hospital. As we in Newcastle have worked together in perfect harmony for many years I think I cannot do better than describe to you our arrangements. We have 90 beds

served by an obstetric staff of 3 senior obstetricians, a first assistant, 2 registrars, and 2 house surgeons. The paediatric staff consists of a senior, an assistant, and a resident registrar. There are a sister and 6 nurses in the baby unit. The senior paediatrician attends all meetings; he is always at hand with advice on policy; he is often in the hospital, encouraging and co-ordinating the work of his juniors; but he is not troubled with the day-to-day management of the babies. The assistant paediatrician is his executive officer. He, also, attends all meetings. He does a round at least twice a week and is on hand for any interesting or difficult cases. The registrar is resident and always on duty, but his work is so popular that he has no difficulty in finding a deputy when he needs time off or a holiday.

The influence of the paediatric department begins in the antenatal clinic, where a sister holds classes for any women who wish to attend. She talks to them on such subjects as breast feeding, the necessary preparations for the baby, and emphasizes our instructions on the importance to the baby of proper diet to the mother. She has recently been testing the value of antenatal breast expression. In the hospital the paediatric registrar and the assistant paediatrician are often in the wards, but to give a focus to this interest of both sides in the work of the other we have instituted a combined round once a week and this I consider of great importance. The obstetrician takes the paediatricians to see any interesting or difficult cases—it may be such as women with heart disease, toxaemia, tuberculosis, diabetes, or antepartum haemorrhage. They may go to the labour ward, where a forceps or breech delivery is in progress, or a woman who has been in labour 3 days is lying. All aspects of the problems are discussed. The obstetricians are then taken to the paediatric unit, and the progress of all the sick and premature babies is reviewed, but, as the paediatric unit extends over the whole hospital, this may mean a visit to the lying-in wards. This combined round has become so popular that it has attracted visitors from each side and discussion is free and full.

In the labour rooms and theatre the paediatric registrar is present for all complicated and difficult deliveries, and also for a good number of normal deliveries. He is seen in the lying-in wards frequently, though the greater part of his work is, of course, in the management of sick and premature babies. He attends the postnatal clinic in conjunction with the baby clinics.

Once a month there is a staff meeting when a monthly report is presented by each of the obstetric and paediatric registrars. These meetings are full of interest—so much so that I do not think I ever remember either registrar being able to complete the reading of his report. No set subject is put down for consideration, but very soon we diverge into a discussion on some of the points raised. Examples of some of the subjects we have talked of are:

Do drops in the eyes of newborn babies do good or harm?

Should the mouth be wiped at the time of delivery, and if so with what?

Why do twice as many babies die after Caesarean section as after normal delivery?

Is induction of premature labour for toxaemia a worthwhile procedure?

In long labour is it worth while injecting the baby with antibiotics during the labour?

Should the cord stump be kept completely aseptic?

I could go on with a much longer list and I might say that the talk brings in physicians and anaesthetists. I submit that we all become better doctors as a result. Being north countrymen we do not hesitate to advance our views or to argue.

We have travelled a long way from the point when the obstetricians laid down which babies were whose. There is now no rule at all as to when the paediatrician "takes over". He is an obstetrician. We obstetricians have ceded none of our responsibility or our interest in the baby—we are still paediatricians—good doctors. If I hear objections that personalities enter into the problem—that such and such a paediatrician is not the sort of man who would work freely in double harness—I can only say that I do not believe it. Look first to the beam in your own eye. Even obstetricians have been known to have temperaments.

We obstetricians occupy a well-marked sector

in our art and our science. Our paediatric colleagues are alongside us and their sector overlaps ours broadly. There must be no thought of building a partition so that each knows exactly his limits. We must mingle and fuse so that the limits of paediatrics reach far into obstetrics and those of obstetrics far into paediatrics. The day of individual know-all is done. We must learn to work as a team. There is enough known and so much as yet unknown in obstetrics that one man has his attention fully engaged. Think of the new discoveries in paediatrics over the past few years. The elucidation of erythroblastosis, the physiology of the premature infant, the effect of virus infection during pregnancy, galactaemia, retrolental fibrocystic disease. Is it possible for a man to be expert in all these and at the same time to keep ahead in obstetrics. Be assured that other new paediatric diseases will be found in time. Note how the diseases I have mentioned are spread in their time from the early weeks of pregnancy to weeks or months after birth. Is it reasonable to say to our paediatrician, " Thus far shall you come and no farther "?

Finally let me say that the patient we have been discussing belongs neither to obstetrician nor to paediatrician—it belongs to its mother. We are both pledged to serve her and her baby.

DISCUSSION

DR. BERYL D. CORNER (Bristol)

" IT is only from the past that one can judge the future " is apt for this among many other topics in medicine. The most superficial glance into medical history reveals that in times past the functions of the obstetrician and paediatrician were carried out by one person, the physician-accoucheur. He left his mark in many treatises entitled " Diseases of Women and Children ", which included details of complicated obstetrical manoeuvres, as well as descriptions of routine care of infants and children, and many symptoms of disease in infancy and childhood. Ballantyne in his classical work on foetal pathology anticipated trends of thought in which the paediatrician is now intensely interested. In the Universities there were lecturers on diseases of women and children, and at Aberdeen it was not until 1892 that obstetrics and paediatrics were recognized as separate subjects. Advances in medical knowledge during the last 100 years have, therefore, caused this common trunk to divide into two branches which from their origins must always be complementary to each other.

Once the tree had branched there followed a period when obstetrics as a speciality raced far ahead of paediatrics. The reason for this is easy to find. It was largely economic but also partly due to the limited methods of investigation available, such as modern biochemistry and radiology. The value of child life was not very high at the beginning of this century, when the infant mortality rate in the cities was 163 per 1,000 live births. The parents of young children were usually the poorest members of the community and in consequence there were but few paediatricians available to concentrate on the problems of early life. The infant consequently remained shrouded in a veil of empiricism concerning its behaviour and care in health and disease, and was largely delegated to midwives whose practical skill and devotion have often been of the highest order, but who lacked the support of scientific knowledge. The result was an appalling loss of life in the first few weeks, and a high morbidity which sometimes left its permanent mark on the child.

We now stand at the middle of this century, with the value of child life never before so highly placed in this country, and a lusty growth of paediatricians eager to take their rightful place as equal branches of the old tree with their colleagues the obstetricians, and to tackle the pressing problems of the newborn infant. It is only the time-lag in growth of the paediatric branch which has led to any fears of difficulty in maternity units arising from this partnership,

which from its nature must be as close as that symbolized by the mother and her child.

The mature paediatrician emerging from his embryonic training period has one glaring fact ever before him, that death and disordered health in childhood are very largely preventable, and that it is far more important both economically and to the life of the nation, to keep an infant alive and healthy than to add a few more years of possibly not very comfortable existence to an old person. The paediatrician's fundamental approach to his work, therefore, differs from that of many of his professional colleagues, although it is closer to the obstetrician's outlook perhaps than any, since recent advances lay such stress on preventioin in both specialities. Every paediatrician must firstly be an active investigator all the time into the causes of the problems that beset child health. We are still only on the fringe of knowledge of the normal functioning of the baby's body whether *in utero* or during infancy. As an example of this one may quote the still unsolved mysteries of renal and endocrine physiology, and such problems as the control of electrolyte balance, which clinical experience suggests differs considerably from that of older age groups. As a corollary to these activities, he must secondly be an educator and supervisor of those responsible for the care of the child. Only thus can the results of his investigations be fully implemented to the achievement of the ideal, which is optimum physical, mental, and spiritual health for every child, leading to the emergence of the satisfactory adult.

In these activities there is nothing static. New advances in science mean constant change of methods and outlook, and the mother and nurse look to the paediatrician to provide them with the practical applications of new knowledge. Outstanding examples of this are in the details of the nutritional needs of the child, the prevention of infection, and the proper psychological handling appropriate to each stage of development.

The next essential funcion of the paediatrician is to ensure that early diagnosis of clinical abnormality is made. The margin between life and death in the small infant is so narrow that the time factor is of paramount importance. To achieve this object, patient training of those caring for the child in the minutiae of clinical observation and the accurate recording of their findings is fundamental. The meticulous clinical observation needed in the nursing care of infants is, I believe, peculiar to paediatrics and is difficult to understand or appreciate by those not familiar with the handling of babies. I know of no more reliable or better clinical observer than the expert premature baby nurse. Throughout the 24 hours every detail must be noted about her small charges, and the slightest deviation from the normal calls for immediate investigation and correction. How often has one been called in to a moribund baby to find that an important observation indicating the start of its illness was either not made or else disregarded until too late to save the child's life. The fourth, and perhaps the least important, function of the paediatrician at the present time is the treatment of the diseased child.

A brief survey of vital statistics reveals at a glance why the paediatrician feels that his most important work today lies in the maternity unit. In the City of Bristol (population 442,700), the infant mortality rate in 1944 and 1945 was 35 per 1,000 live births, a low record compared with pre-war years. Of these deaths, 57 per cent occurred in the neonatal period, a rate of 20 per 1,000 live births, and 60 per cent of neonatal deaths were due to prematurity and asphyxia. Since that time a full paediatric service has been provided in all except one or two very small maternity units in the city. In January 1946 the first premature unit in the city was opened and since early 1950 special care has been provided for all premature babies, whether born at home or in hospital, with direct or indirect supervision by a paediatrician. The vital statistics for the year 1951 show an infant mortality rate of 23.7 deaths per 1,000 live births, and a neonatal mortality rate of 13.39 per 1,000 live births, the latter rate being 2.4 per 1,000 lower than the 1950 figure (15.78), which was a low record for the great towns of England and Wales. Although there has been a considerable reduction in neonatal mortality it still remains 56.5 per cent of the total infant mortality, a rate well above the incidence of lethal congenital abnormalities, and therefore

indicating that there are still some lives to be saved. When one comes to this low figure, which represents a total of about 100 babies, further improvement involves the closest scrutiny of every death and an even higher standard of supervision of all newborn babies. It is perhaps important to note that in this city just over 70 per cent of births take place in hospital.

Perhaps even more important than the actual figures for mortality is the large amount of morbidity which is known to occur in this age group. A low neonatal mortality rate can be considered as an index of the standard of neonatal care and this is of paramount importance to the paediatrician. A newborn infant who has been ill, particularly with infective illness, or who has had bad feeding problems in the maternity unit and returns home in a suboptimal condition, is a considerable liability during the ensuing few weeks. Ground has been lost which it will take some time to regain, apart from more serious hazards that may arise, particularly in homes of poor standard, with ignorant or careless mothers.

What are the practical applications in the maternity unit of the paediatrician's outlook? First, and of the greatest importance, he or she is essentially a teacher, instructing junior medical officers and midwives in the day-to-day care of the infant, introducing new techniques and keeping over-all supervision of the arrangements for the care of the infants. The diagnosis of the normal child may be one of the most difficult to make in medicine, and he must be quick to point out the significance of unusual happenings and ready at the earliest moment to diagnose and treat any abnormality that arises. The paediatrician emphasizes in the department the importance and vulnerability of the infant, and only when all the staff realize that even the most trivial happening may have grave consequences for the infant can we hope to reduce the infant mortality and morbidity rates. He is there to prevent trouble and delay in dealing with abnormality. He must be ready to advise on the administrative aspects of the unit as they affect his work in connexion with staffing, buildings and equipment. He would like to help the obstetrician in the antenatal period by giving advice on the prognosis for the infant at different gestation periods, when the question of premature termination of labour arises. When abnormality is anticipated, for example in the diabetic mother or possible haemolytic disease of the newborn, he can advise on the most suitable arrangements for the investigation and care of the child and be prepared beforehand to deal with the situation as soon as it arises.

The maternity unit offers great scope for fundamental research on problems which can only be tackled in collaboration with the obstetrician. To mention only two in which the paediatrician has great interest, since he sees the distressing after-effects only too frequently: the causation and prevention of congenital abnormality, and the physiology and pathology involved in asphyxia neonatorum and its treatment. He desires to offer his special knowledge of physiology and techniques for dealing with infants, in the joint effort to elucidate these as well as many other mysteries.

In practice there is only one slight difficulty that is at all frequently experienced. The pressure on obstetric beds is usually great, and the paediatrician, looking ahead as he always should be, may sometimes rather inconveniently desire to retain a baby in hospital beyond the expected date of discharge, and in most cases this means the mother also. His work in follow-up clinics reveals only too frequently the distress and even danger that is apt to arise when a baby is sent home with trivial skin sepsis or feeding not thoroughly well established. I would stress that this possible cause of friction can so easily be eliminated by taking these facts into consideration when maternity accommodation is planned, and in all large units there should be set aside special accommodation to which such babies and their convalescent mothers can be transferred. In training schools for midwives and medical students these patients are valuable teaching material and apart from such considerations as the risk of cross-infection and the psychological effect on the mothers, they are better not transferred to sick children's hospitals, but should remain closely associated with the maternity unit.

Harmonious team-work is greatly helped by regular meetings at which obstetricians and paediatricians freely discuss the work of the

department and the clinical or research problems that may arise. Both have much to learn from each other. The paediatrician must certainly keep up to date with advances in the management of pregnancy and labour, and the interest of the obstetrician in the welfare of the baby can be readily maintained and stimulated by such meetings. History has shown how doctors in other branches of medicine, by their study of the child, have made startling discoveries which can have fundamental bearing on the management of pregnancy; such were the discoveries of the rhesus factor and the effect of virus infection on the foetus in the early weeks of pregnancy. In the two teaching units in Bristol meetings are held very frequently at which the obstetric-paediatric team presents statistics and discusses interesting cases. Quarterly meetings are attended by all teams in the clinical area. These meetings have helped tremendously in creating a true team spirit and overcoming any distrust that might otherwise have arisen, apart from their great value to the total work of the department.

These functions of the paediatrician in the maternity unit cover a broad field, and it is essential to their proper performance that he should be recognized as a full member of the team and an equal consultant with his obstetric colleagues. The phrase " the paediatrician has been called in " when applied to a sick newborn baby is in conflict with his whole approach. He is already in the maternity unit, and watching every baby in order that it may be steered through to health and safety in the shortest possible time. The present age is one in which advance in medicine is only likely to be achieved through team-work, and as we look again at the history of the subject, there can be no more appropriate team than that in which the obstetrician and paediatrician find themselves together. Improved obstetrics, paradoxically, leads inevitably to greater demands on the paediatrician and closer association with his obstetric colleague.

Dr. E. Cope (Birmingham)

Obstetricians, with few exceptions, have accepted the fact that the paediatrician has not only entered the maternity department but has come to stay and, having with good grace accepted that fact, we must consider how best his services can be employed. I say this advisedly, for I fear that before long he will insist on caring for the baby before it is born, and we will merely be employed for the mechanical act of separating his patient from the mother. Indeed, the late Sir Leonard Parsons (1946) stated that " the paediatrician of the future must be concerned with the well-being of the child from the moment of its conception ".

I have received my training during the years in which the bloodless revolution has been taking place, and have seen various stages of the battle in various centres, and from various levels in the obstetrical hierarchy. I have been forced to take the worm's-eye view of the obstetrical house-surgeon, and privileged to take a bird's-eye view of the obstetrical consultant.

The first system under which I worked was one in which the care of the babies was supervised by the obstetric consultants through their resident medical staff. The paediatrician did a teaching round once a week, and was shown all the babies that presented special problems. He was also available for consultation. The chief advantages were, first, that there was continuity of treatment and the mother felt that her baby was being cared for by a doctor she knew and in whom she had confidence, and secondly, that the resident obstetrical staff received a thorough training in the care of the newborn. This is of particular importance because the majority of babies are born at home, and in the future will be cared for by general practitioners who have held a resident obstetric appointment.

The main disadvantage lay in the absence of administrative machinery for the follow-up of babies.

We have in the past judged our success or failure as obstetricians largely on the maternal mortality, stillbirth, and neonatal death rates. We have, furthermore, appreciated the importance of the delayed morbidity that can occur in the mother because we are also gynaecologists. We have, however, very little knowledge of the delayed morbidity that may occur in the child.

In his follow-up from the womb till the age of 14 years, the paediatrician may disclose facts

that will revolutionize obstetric practice. He may show that in cases of prolonged labour with marked head moulding, there is an unduly high proportion of psychopaths or of low-intelligence types. He may discover a similar state of affairs following breech delivery, or difficult mid-forceps. Indeed, we may have to discard the forceps altogether, though it is possible that the present leading position of the United States in world affairs may be directly related to their high forceps rate.

Surprisingly little work has been done on the relationship of birth trauma to subsequent mental development. Most of the papers have tackled the problem in retrospect (Schachter, 1950; Malzberg, 1950; Roudinesco *et al.*, 1947; Penrose, 1949). One of the best and most recent papers, and one in which the problem has been tackled from the right end, is by Craig (1950), who has personally followed up a series of 593 cases. Unfortunately, the majority of cases were only followed from 3 to 5 years, and the author states that the "investigation consists of a clinical study based upon clinical material unavoidably selected in such a way as to preclude statistical analysis".

It is of interest that the only two papers which I have found on mental development following neonatal asphyxia have shown that there is no significant relationship between these two conditions (Campbell *et al.*, 1950; Wetterdal, 1951).

The paediatricians will no doubt also produce some useful evidence on physical development, once they have settled the problem of velocity versus distance.

The next system was one in which the care of the babies was taken over by the Professor of Paediatrics. A resident paediatric registrar was appointed, and an adequate follow-up system instituted.

The resident obstetric staff became divorced from the babies, and, having no personal responsibility, tended, with few exceptions, not to maintain the high interest that they had previously shown. We have already indicated that this attitude, if wide spread, would reduce the efficiency of the maternity service as a whole.

The paediatric registrar had not held an obstetric appointment, and therefore had little experience of the newborn. This, of course, commonly applies to the paediatric consultant, who may take over the care of the babies in a maternity unit having seen little of the newborn since his student days, and it is not unknown for paediatricians to have seen more postmortems than live births.

Such a state of affairs tends to create a lack of confidence in the mind of the obstetrician, and on this account I feel that paediatricians should be required to have held a resident obstetrical appointment before taking charge of newborn babies.

That great paediatrician, Sir Leonard Parsons (1946), in his Blair Bell Memorial lecture, said that "it is only since I have been engaged in the study of neonatal disease and death that I have realized how greatly I have been handicapped by my ignorance of midwifery".

It is not sufficient to have held a resident paediatric appointment in a maternity unit, as obstetrical problems can only be fully appreciated if one has had personal responsibility for the patients. Furthermore, it is not possible to work out the syndromes associated with the trauma of delivery unless one has conducted a large number of difficult confinements. Roberts (1949) suggests that the paediatrician should learn how to use a laryngoscope and take charge of the infant as soon as it is born. It is not likely that even in the most expensively manned unit there will be a paediatric registrar immediately available for every confinement, nor is it desirable that there should be, for he may well become another obstacle between the womb and the warmed cot. It is more logical that every obstetrical registrar should be able to use a laryngoscope, and all those of my acquaintance can.

A further disadvantage of this system is that there may be lack of continuity of treatment. Having successfully effected a difficult delivery, possibly from an infected womb, the obstetrician will prescribe treatment for the baby who may be warded just before the paediatrician's round. Unless there is considerable understanding between the two specialists, the treatment may be altered within a few hours. This leads to confusion, and adds to the difficulties of the nursing staff.

Of interest here is the division made by Baar

(1946) into the "early" neonatal period which is the first week of life, and the neonatal period which is the first 3 months. He points out that the chief dangers in the first week are associated with birth trauma, and that the problems which occur in the 3rd and 4th weeks are much the same as occur in the 8th and 10th weeks. It seems to me reasonable that the obstetrician should supervise the "early" neonatal period, after which the baby is more properly in the province of the paediatrician.

In this system, too, the question of who should supervise breast feeding, including the antenatal care of breasts, must arise. A policy must be decided upon which is to the mutual satisfaction of both obstetrician and paediatrician. It must be one with which the senior nursing staff is in sympathy, and it must be made clear to them whom they should approach when serious feeding difficulties arise.

A further disadvantage of this system, in which paediatricians are responsible for the babies through their own registrars, is that the already overworked nursing staff have to give time to yet another group of doctors.

The last in my list of disadvantages is that the obstetrician, being divorced from the babies, may embark upon his rounds not fully conversant with their health, and may be considerably embarrassed by some mother who asks about the progress of a baby concerning whom he knows little. Even more important than his embarrassment is the lack of confidence that this may engender in the minds of the patients. This can be overcome to some extent by the paediatrician visiting the mothers of the poorly babies.

The third system, which I believe to be the most satisfactory, was one in which the babies were the responsibility of the obstetrician. The paediatrician did a round of the babies about 3 times a week accompanied by the obstetric residents. In addition, a paediatric registrar who had no direct clinical responsibility initiated the record sheets, and made careful day-to-day notes of all the babies. The record and follow-up sheets were devised by the paediatricians and discussed at a combined meeting of the two departments. The Follow-up Clinic was, of course, the responsibility of the paediatricians.

This system worked extremely well. It gave an optimum service to mother and baby, allowed of excellent training for the obstetric residents, and made available all the material that was required for clinical research. The smooth running was due largely to the high level of co-operation that one would expect in the hallowed environment of an ancient seat of learning, and in part to the availability of a sufficient junior medical staff.

The last system of which I have had experience, is next in order of preference to the above. The babies after warding became the responsibility of the paediatrician. The obstetric residents acted within the department as their house physicians and there was free discussion between the two groups of specialists on all clinical and administrative points.

The advantages are that the obstetric residents receive adequate training, the obstetricians are kept fully informed of the progress of the babies, and it allows of adequate facilities for clinical research.

The disadvantages are those previously described as being due to divided responsibility.

The care of premature babies is a special problem, and the methods now available allow little room for improvement (Drillien, 1947). What matters is not which specialist cares for them, but that he should be an enthusiast. The only real hope for the future is that the causes for prematurity will be eradicated, and here the co-operation is required not only of the paediatricians but of the pathologists, physiologists, and the politicians. Similarly, the problems of rhesus responsibility and asphyxia neonatorum can only be tackled on the basis of wide co-operation and planned research.

It will be seen that the paediatrician is an essential part of all four systems, but in different doses. His particular value lies in his ability to follow the babies after they leave the department, and it is to be hoped that the arrangements for so doing, which have been devised in the City of Leeds and the West Riding of Yorkshire, will be widely studied (Craig *et al.*, 1951).

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Mr. A. Ambery Smith (Leeds)

Before I start I would like to say something about some of the points made by the two openers of today's discussion. Mr. Stabler suggested that paediatricians should attend the antenatal clinics and Professor Gaisford talked about " antenatal paediatrics ". I have the feeling that when this phrase is used the meaning which is intended is better expressed by the terms foetal physiology and foetal pathology. Now these are certainly vast fields, largely untilled, and anyone is welcome to labour in them. But to use the word paediatrics implies more than investigation because the Greek word *ἰατρεια* implies therapeutics. The treatment of the mother and baby while the child is *in utero* will remain and should remain the duty and the responsibility of the obstetrician. And this will still be true no matter how many radiologists, pathologists, serologists, and biochemists are there to help him. In this sense of the word—and I submit that it is the only proper usage—antenatal paediatrics is obstetrics.

I well remember going last year with Professor Claye to Edinburgh to hear him lecture on the indications for Caesarean section. I also remember that Professor Dugald Baird, who was in the chair, opened the discussion after the lecture by pointing out how interesting it was that Professor Claye had been almost entirely concerned throughout his address with the welfare of the baby. Caesarean section in pre-eclampsia, in the baby's interest; placenta praevia; foetal results in unstable lie; Caesarean section in uterine inertia to save babies; these were the subjects that Professor Claye discussed that night. This is modern obstetrics, and it seems to me that it is the only thing deserving the name of antenatal paediatrics. I do not think—and I say this with the very greatest respect—that Professor Gaisford is justified in implying that the obstetrician is so taken up with the mother that he is only secondarily or slightly interested in the baby.

Professor Gaisford also used the phrase " paranatal paediatrics ". Now, although I am charmed by the alliteration, the word paranatal will not do. It has one Greek and one Latin parent. It is not legitimate. I know that it is the duty of a paediatrician to treat illegitimate babies with exactly the same care as those born in wedlock, but there seems to me to be no reason why he should carry this tolerance into philology.

Mr. Stabler asserted that there is no problem about the place of the paediatrician in a maternity unit, but it is a fact that there is no general agreement on this question either here at home or in the United States of America. Even in this city three different systems are in operation in the three big maternity hospitals, and this in spite of the fact that the regional units are both staffed by men from the teaching hospitals. It seems to me that the three different arrangements should be mentioned.

In the first the paediatrician undertakes the routine care of all babies from the moment the cord is cut.

In the second the paediatrician visits the obstetric unit regularly to see the sick babies, and at other times for consultation about particular babies. He is responsible for the care of sick babies once they have been handed over to him and is in a general sense adviser to the obstetricians, residents, and sisters.

In the third the paediatrician is called in only when the obstetrician wants help with a specific case.

Now the only arrangement of which I have close personal experience is that in which the paediatrician takes over complete control of all the babies at birth. At the Leeds Maternity Hospital this system was adopted 5 years ago with the agreement of the obstetricians. This plan has worked well and smoothly, and for my part —and I have been as closely concerned in the

day-to-day practice of the hospital as anyone—I have had the happiest possible relationship with the paediatric staff. In view of this I am sure I will not be misunderstood if I point out some effects of this plan which are less than ideal.

Where the obstetrician is cut of from all responsibility for the baby after delivery he may be expected to lose a part of his former interest in its progress. It is idle to say that this should not happen; in clinical medicine interest and responsibility go hand in hand. In many cases the most important factor in the baby's progress after birth is the type of obstetrics which has been practised before and during birth. It seems to me that the ideal system will be one in which the obstetrician not only sees his results but actually feels responsible for them. Without this important corrective it will not be difficult for some to follow courses which are irresponsible. I sometimes wonder whether obstetricians would have so readily followed the Liverpool lead in doing Caesarean sections in cases of pre-eclampsia where the baby is very premature if they had seen more of, and had had some responsibility for, the babies after delivery. I do not say that this is bad obstetrics. All I say is that the achievement of a balanced attitude towards this sort of trend is helped where the obstetrician is responsible for the postnatal care of the baby. I know that of 8 Caesarean sections I have done for this indication, 5 of the babies have died; but I know it because I have been particularly interested in this matter. I have not had the experience of looking after them. I think this sort of consideration applies with equal force to the whole subject of the difficult forceps delivery and to the paramount importance of gentleness in obstetrics. In other words, I believe it is possible for a type of obstetrician, once he has relinquished the care of the newborn, to think that his responsibility ends when he hands over a baby which is in a technical or legal sense alive.

There is another point in this arrangement about which I feel some concern. Since the war the Leeds School has sent out 8 obstetricians into independent consultant practice. Of these only 3 are employed, and that for only part of their time, in hospitals where the paediatrician assumes immediate and complete control of the baby at birth. Five are in full charge from the medical side of many of the babies they deliver. It seems to me to be likely that this will be true for as long as it is reasonable to look ahead. Is it not wrong to put this onus on to people with no experience in looking after newborn babies?

Carrying this a step lower down the scale, it is the policy of our Royal College to restrict the practice of obstetrics by general practitioners to those who have had postgraduate experience. I believe wholeheartedly that most multigravidae who are obstetrically normal should be delivered at home by midwives, backed by the advice of well-informed general practitioners. Unless obstetricians are really keen to encourage the growth of such a system, the diploma in obstetrics is little more than a confidence trick. Eight house-surgeons go through the Leeds Maternity Hospital each year and of these 6 subsequently take the diploma. That is to say that since the war about 30 doctors have worked in this one hospital and taken their examination with the intention of doing obstetrics in general practice. To my mind it is regrettable that they have had little or no experience in the resuscitation and care of the newborn during their postgraduate obstetric training. It may be argued that they have had the opportunity of seeing the work that is done by the resident paediatrician, but postgraduate training is most effective when it is coupled with responsibilitiy. So long as a house-surgeon is prevented by rule from ordering any treatment whatever, so long will it be fair to say that he is not receiving postgraduate experience.

These are the reasons which lead me to the belief that some place must be found for house-surgeons and registrars and consultant obstetricians to share the responsibility for the care of newborn babies.

PROFESSOR W. I. C. MORRIS (Manchester)

IN discussing the place of the paediatrician in a maternity unit it is necessary to remember that the largest number of maternity units exist in hospitals away from the main teaching centres, in circumstances where it is not possible to provide a complete paediatric service. Further-

more, many maternity units are staffed entirely by general medical practitioners. In such circumstances, the place of the paediatrician is that of the occasional consultant, and responsibility for the day-to-day care of the babies must continue to be shouldered by the obstetricians. Arising from this, it is obvious that it is still vitally necessary in the teaching centres to train obstetrical house-surgeons and registrars in neonatal paediatrics, and that it is highly desirable that trained obstetricians, whether specialists or general practitioners, should have the opportunity to attend paediatric refresher courses.

In the close collaboration of paediatrician and obstetrician which all desire in the teaching centres, sources of friction exist despite personal goodwill. One of these, perhaps the most important, occurs in circumstances where the paediatrician confines himself to pastoral visits, leaving the general care to junior assistants of one grade or another. The consultant obstetrician attending much more frequently finds this a source of irritation. The management of breast feeding difficulties also presents a possible field for disagreement. Here, the over-enthusiasm of the young paediatrician for breast feeding at all costs requires to be contested, though of course the peremptory discontinuance of breast feeding on the instruction of the obstetrician can be equally annoying. In the resuscitation of the apnoeic baby a field for mutual criticism is obvious. This is most marked when the resuscitation is undertaken by a junior member of the paediatric staff, either medical or nursing. It might well be that this duty may yet be taken over by the anaesthetist, with yet another subdivision of control.

It is hardly possible to form detailed rules to avoid these difficulties. As general principles, however, it is possible to defend the following:

(*a*) In the labour room, care of the baby might be delegated to a paediatrician of equal status and experience to that of the obstetrical operator.

(*b*) In the lying-in wards and nurseries, the care of all babies, and the control of breast feeding of all healthy mothers could be delegated to the paediatrician, subject to the unchallenged right of the obstetrician to take control of the breast management in any case where the physical or mental condition of the mother appears to him to make this desirable.

(*c*) The obstetrical house-surgeon should be made responsible for some agreed portion of duties in the nurseries and in the follow-up child welfare clinic.

Dr. GABRIEL (Melbourne)

I SHOULD like to tell you about the arrangements at the Women's Hospital, Melbourne, in which some 7,000 deliveries take place each year. We are indebted to our original paediatrician, Dr. Kate Campbell, and it is largely due to her work that others have become interested and that there is now a complete paediatric staff attached to the hospital. In addition to Dr. Campbell there are 2 male paediatric physicians and 1 paediatric surgeon. They make regular visits to the hospital and are available to deal with emergencies. They are also on the staff of the nearby Children's Hospital and this forms a valuable link.

Our senior house-surgeons at the Women's Hospital serve a minimum time of 3–4 months during their second year as paediatric house-surgeons. They are trained by the paediatric honoraries and maintain a daily contact between them and the babies. We greatly value the advice, guidance, and even instruction that these paediatricians give us. Each month there is a staff meeting at which the paediatricians are asked to tell us why a baby died and they have got almost to the stage of saying, "You should not have put on the forceps there," or "You should have put them on earlier." These staff meetings have taught us a lot and made us realize the value of the paediatrician.

The Women's Hospital, Melbourne, is in the process of a rebuilding scheme, and the paediatrician and not the obstetrician has designed the nursery. The paediatrician, both in hospital and private practice, is often called in when difficult deliveries are expected and particularly when we have ahead of us the delivery of what we term a "premium" baby. In these cases they take the baby from the obstetrician and its resuscitation lies largely in their hands.

We are very grateful to these ladies and gentlemen for their guidance in many things of which I will mention the following.

Their insistence on putting the mother on penicillin 12 hours after we rupture the membranes, in the interest of the baby. The treatment which is being used in Australia against rubella infection early in pregnancy. The habit of using a catheter as a suction dredge, pushing it down the throat of the baby and extracting not only mucus but also sheets of epithelium, has been largely stopped by the paediatricians. They have asked us to stop bathing the sick baby after delivery.

While the mothers are waiting at the antenatal clinic a tutor sister, trained in paediatrics, more or less entertains them with different aspects of care for their babies. Finally I would like to say that the female makes a very good paediatrician.

FRANCISCO A. URANGA IMAZ and JUAN J. MURTAGH (Buenos Aires)

IN the hospital at Buenos Aires in which we work, the paediatrician assumes responsibility for every newborn infant up to the age of 2 years, supervising its feeding, nursing, vaccination, etc. There is, however, close collaboration with the obstetrician. During the last few years, the paediatrician has taken over the duties of resuscitation of the anoxic baby in the labour ward, being present at every confinement. There is a rota of duty, each physician on the paediatric staff taking his turn. At present, owing to shortage of resident staff, the obstetricians attend cases during the night. The head nurse of the paediatric service is the link between this and the obstetric service, and it is her duty to call the paediatrician whenever there is an operative delivery or when an anoxic baby is born.

Premature birth presents its own special problems: premature and immature babies fall directly under the paediatrician's care from the very moment of birth. Another condition demanding close collaboration between paediatrician and obstetrician is that of erythroblastosis. During pregnancy, the routine laboratory tests are carried out on the mother's and father's blood. As soon as the baby is born, the paediatrician makes his examination and determines the correct line of treatment.

It is by such close co-operation that the obstetrician, paediatrician, and postgraduate students enlarge their experience in the important field of child welfare.

PROFESSOR LENNON (Bristol)

I REALIZE fully this morning that I must be one of the stiff-necked obstetricians described by Professor Gaisford, but I hope the discussion has stimulated obstetricians to a sense of their responsibility with regard to the baby. It is necessary for obstetricians to appreciate their responsibility. The paediatricians already do, and they do not need any encouragement. Now the obstetricians are much to blame for their great lack of interest in the baby and must shoulder responsibility for the invasion of the speciality by the paediatrician. It is perhaps true that only one obstetrician in recent years has taken particular interest in the babies and done a real piece of work. I refer to Sir Eardley Holland. He is the one obstetrician who has really done good research on the baby during the last two decades. It is necessary to point this out because it is a warning against further loss of territory.

For example, this talk about antenatal paediatrics. Antenatal paediatrics is, of course, obstetrics. Paediatrics as a speciality has now reached maturity. It was treated in its asphyxial stage some 20 or 30 years ago by the obstetricians, who gave it more than a liberal supply of oxygen, and then left it completely alone. The child grew and, as children do when unchecked, it took liberties. Now that this child has become a man it should put away childish things, it should be given its place in society and its sphere of influence defined.

I refuse to have a paediatric houseman or housewoman, as is more usual, to resuscitate my babies, when very often he or she has never done an obstetric house job. How often does one see the paediatric consultant in the labour room during the night? Yet the paediatricians want control of resuscitation! As obstetricians we have a duty to protect our speciality. We must

be interested in and know about babies. Are we to go around our obstetric wards talking to mothers with no knowledge of how the babies are, because we are no longer in charge of them? For administrative matters the obstetricians must be in charge in the maternity block.

As obstetricians and gynaecologists we see our decks assailed, Mr. Chairman, on all sides. In this case by the paediatricians; and in others by the radiotherapeutists in the treatment of uterine cancer; by the radiologists telling us when to do Caesarean section for misproportion; and by the midwife who wants control of normal labour. The wealth of interest in our speciality is an attraction becoming apparent to all. We must keep our interests intact. We are still afloat: see that we remain afloat.

Professor Gaisford (*Reply*)

Professor Gaisford, in his reply, expressed his thanks for the honour of having been invited to participate in the discussion, and emphasized the fact that paediatricians were fully aware of the great debt they owed to obstetricians.

The discussion had been interesting and, in may ways, illuminating. There were many problems and there was no single way of solving all of them. He and Mr. Stabler had been talking particularly of the work in teaching units and the arrangements which proved satisfactory there could not be applicable in peripheral units where there was no regular paediatric care.

When once it was realized that obstetricians and paediatricians both had the same aim in view—the well-being of the baby—then in the achievement of this aim there should be no grounds for disagreement in principles, although practices might vary according to local circumstances.

Professor Gaisford apologized for having meandered from the path trodden in the summary circulated before the meeting but averred that such deviations did not denote any change of views—they merely expanded them.

Mr. Stabler (*Reply*)

There is little that I can add to the summing up that Professor Gaisford gave you. I did make one or two notes on the points that were raised and I would like to say just a word or two about them.

Both Dr. Cope and Professor Lennon seemed to me to be to some extent led away by words, by terms, by calling a man a paediatrician or calling him an obstetrician. They must both be both. Dr. Cope, for instance, prefaced some of his remarks by saying that unless there is considerable understanding between the two, the obstetrician might become divorced from the babies. He might visit the ward, meet the mother and feel considerably embarrassed because he was asked about the progress of the baby. He is not doing his job if he is divorced from the babies, and he must make it partly his responsibility to be to a large extent a paediatrician. He must be in charge of the babies as well as the man whose nomenclature is a paediatrician.

Mr. Ambery Smith mentioned that paediatricians might even be invited to the infertility clinic. I would be delighted to see them there and that is what I meant by saying that a paediatrician was even concerned with the health of a couple before conception. He also said that the Leeds School was sending out consultants and men who took the diploma in obstetrics who had, in his own words, " no training at all " in paediatrics. In that case I had better issue a warning now to the Leeds School, that when these men come up for the diploma examination I shall hammer them hard on paediatric questions. They had better start now and get their noses well into the paediatric department.

STRESS INCONTINENCE OF URINE

OPENING PAPERS

I. ALBERT ALDRIDGE, M.D.
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INVOLUNTARY leakage of urine resulting from incompetence of the urethral sphincter mechanism is one of the frequent and most distressing symptoms for which gynaecological patients seek relief. As a rule it is due to obstetric trauma. However, it may be the result of surgical trauma or unsatisfactory wound healing following any vaginal plastic operation involving the urethra and anterior vaginal wall. Other conditions which predispose to its occurrence are congenital underdevelopment of the urethra and its supporting structures and involutionary tissue changes incidental to the menopause.

Stress incontinence due to obstetric trauma may occur soon after delivery and may or may not disappear when postpartum involution is complete. Many parous women who have obvious birth injuries to the urethra and anterior vaginal wall may not develop stress incontinence until many years after their last deliveries. They may seek relief for the first time at or after the menopause because leakage has started at this time or because it has increased and produced unbearable discomfort. This is probably due to the fact that damage from the original birth injuries was insufficient to cause leakage until it had been increased by the physical stress and strain of life and menopausal tissue changes. Congenital underdevelopment of the urethra and its supporting structures may lead to stress incontinence in nulliparous women and may add to the severity of birth injuries in parous women.

The amount of leakage varies from an occasional few drops of urine to total incontinence and is related directly to the extent of damage to the urethra and bladder and to their supporting structures. As a rule leakage occurs with various types of physical strain, such as coughing, sneezing, and lifting, and for this reason is referred to as "stress incontinence of urine".

By cystometric and roentgen studies, Barnes (1940) has shown that control of urination depends upon normal functional balance between the urethral sphincter mechanism and the expulsive force of the bladder. In other words, leakage of urine may occur through a normal urethra if intravesical pressure becomes excessive. Conditions which are known to create abnormally high intravesical pressures at times include:

(1) External pressure on the bladder from large pelvic tumours or a pregnant uterus.
(2) Uterine prolapse.
(3) Abnormalities of motor innervation to the bladder musculature resulting from conditions such as spina bifida, traumatic injuries to the lumbar spine, or multiple sclerosis.
(4) Reflex irritability of the bladder due to inflammatory lesions of the urinary tract.

Any of the above conditions may cause frequency of micturition, dysuria, urgency and, at times, leakage of urine, often referred to as urge incontinence. Incontinence which occurs through a normal urethra as a result of excessive intravesical pressure is not true stress incontinence.

It is known that leakage of urine may be due to a combination of aetiological factors. For this reason it is essential that treatment be preceded by careful diagnostic studies to determine the cause or causes for its occurrence. The value of such studies can be demonstrated by the fact that elimination of an inflammatory lesion of the urinary tract may be followed by complete relief of incontinence or marked decrease in the amount of leakage. In other words, leakage of

urine may be due to conditions which cause both urge and stress incontinence.

Leakage of the stress type occurs in the presence of fairly constant gross anatomical changes involving the urethra and bladder and their supporting structures. As a rule the urethra and vesical neck are displaced downward and forward from their normal position beneath the pubic arch. The calibre of the urethral lumen is increased by relaxation of its muscle wall and damage to its supporting structures. If relaxation is marked the proximal one-third to one-half of the urethral lumen may remain open and become an extension of the cavity of the bladder, thereby in effect reducing the length of the urethral canal. It has been assumed that the above changes are invariably accompanied by some degree of relaxation, destruction, and perhaps distortion, of the urethral sphincter muscles, resulting in partial or complete loss of their function.

At the last meeting of the American Gynecological Society, Jeffcoate reported on X-ray studies of the urethra and bladder in normal women and in those who had stress incontinence. He presented convincing evidence to support his contention that urinary control depends upon maintenance of a proper angle between the proximal end of the urethra and the base of the bladder.

In recent years considerable evidence has accumulated to prove that control of urination depends to some extent on normal function of the pubococcygeus, bulbocavernosus, ischiocavernosus, and transversus perinei muscles. Kegel (1948) has devised a physiotherapeutic method to restore the function of these muscles which he believes is often impaired by congenital underdevelopment, obstetric trauma, and atrophy of disuse. His results from treatment of stress incontinence confirm the probable importance of normal function of the perineal muscles for control of urination.

Unfortunately we do not yet have complete knowledge of the mechanism by which urination is controlled. For this reason it has been difficult to evaluate the importance of anatomical changes which are usually observed in women who have stress incontinence and to devise well-defined surgical procedures by which control of urination is likely to be restored. However, from clinical experience and our limited knowledge of this condition it has seemed important to:

(1) Reduce the lumen of an overstretched urethra to a size recognized as normal and to restore the shortened urethral canal to its original length.

(2) Repair the damaged, overstretched, and retracted urethral sphincter muscles.

(3) Construct a support from the surrounding tissues to hold the urethra and vesical neck at as high a position as possible in the pelvis.

Results of microscopical studies of the urethra and anterior vaginal wall, reported in 1951 by Krantz of Cornell, failed to reveal any evidence of intrinsic urethral sphincter muscles or of the "muscles of micturition" reported by Kennedy in 1946. If experience confirms the importance of Jeffcoate's recent findings, re-establishment of normal angulation between the proximal end of the urethra and base of the bladder may prove to be an essential step in any surgical technique for relief of stress incontinence.

Management of a patient who has stress incontinence should begin with a careful history and a complete physical examination, including investigations of the urinary tract and nervous system. From these studies it should be possible to determine the probable cause or causes for leakage of urine, to estimate the extent of injuries, and to decide whether pre-operative treatments are needed to improve a patient's general health or to eliminate irritations or inflammations about the vulva and vagina which might interfere with proper wound healing.

In general, operations for relief of stress incontinence should not be undertaken until 6 months after the original injury or a previous operation for the same condition. Urinary tract infections should be eliminated. Incontinence of the urge type may be made worse by operations in use for stress incontinence. Surgeons should take advantage of available means to combat secondary anaemia and vitamin deficiencies, and to ensure an adequate intake of proteins while these patients are under treatment. Wound healing will be promoted also by careful haemostasis, avoidance of tissue constriction by use of too many sutures, and the administration of antibiotics as prophylaxis against infections.

Vaginal operations in use for relief of stress incontinence vary from a simple plastic procedure of the type devised by Kelly and Dumm (1914) to those involving extensive dissection and repair of tissues about the urethra and bladder as recommended by Kennedy (1937).

The original Kelly technique (Kelly and Dumm, 1914) is too well known to require description. Success of this procedure depended upon repair of damaged tissues in and about the proximal one-half of the urethra and vesical neck. It was soon modified by exposure and repair of the damaged, overstretched urethra throughout its entire length. This was accomplished by extending the incision in the anterior vaginal wall nearly to the external urinary meatus. By this modification it was believed also that better support for the urethra and vesical neck could be established than by the original Kelly procedure. Experience proved that about 80 per cent of women who suffered from stress incontinence could be cured by these rather simple vaginal plastic procedures.

The operation recommended by Kennedy in 1937 was devised with the hope that it would prove to be a more reliable vaginal plastic procedure for relief of primary stress incontinence and that it could be depended upon to cure some of the women who had had partial or complete failures from previous operations for the same condition. Published reports should be consulted for details of the Kennedy technique. Briefly it is a vaginal plastic operation involving an extensive preliminary dissection to permit repair of any damage to the urethra, vesical neck, and bladder, and to establish adequate support for these structures at a proper level in the pelvis.

We believe that our surgical results for stress incontinence have been somewhat improved by the Kennedy procedure. Results from its use in other clinics (Counseller, 1943; Phaneuf, 1943) have also been encouraging but it has been difficult to draw conclusions from the small numbers of cases reported. In 1951, Counseller reported on an analysis of results obtained by surgical treatment of 578 patients for stress incontinence at the Mayo Clinic. He concluded that the Kennedy operation had not produced better results than the Kelly procedure for primary stress incontinence. He had found also that the Kelly or modified Kelly operations had been more successful in treating women who had had previous surgical failures.

From all that is known about the female urethra and bladder it seems certain that the mechanism for control of urination is located chiefly in the vesical neck and proximal one-half to two-thirds of the urethra and that proper support of these structures is essential for normal function. Impressed with the importance of providing adequate support for the urethra and bladder, Squier (1911), Reddington (1948), Treahy and Pacey (1948), and Ingelman-Sundberg (1947) have sutured the mesial margins of the pubococcygeus muscles together in the midline beneath the urethra and bladder, or have transferred attached fragments of these muscles for the same purpose. They have reported excellent results from their procedures.

It cannot be denied that some progress has been made in the treatment of stress incontinence, but the 10 to 20 per cent of partial or complete surgical failures and the uncertainty as to the outcome of any vaginal plastic operation have constituted a serious problem for gynaecologists as well as for women who suffer from this condition. It seems obvious that some women are not or cannot be cured by any vaginal plastic operations which have yet been devised. As a result, gynaecologists have resorted to a variety of suprapubic operations which have been used as single procedures or in combination with vaginal plastics.

The author's (1942) interest in transplantation of fascia to relieve stress incontinence was aroused in 1941 by efforts to cure a patient in whom leakage of urine for 29 years had not been cured by three vaginal plastic operations. Following another plastic operation by the Kennedy method and transplantation of fascia to form a supporting sling beneath the proximal end of the urethra, this patient has been continent and free of bladder symptoms for more than 10 years. The aponeurotic fascial sling devised for support of the urethra took advantage also of the recti muscles which are always well developed and in favourable anatomic relationship to the urethra. Support was applied at the point where it appears to be most effective, that is, at the junction of the urethra and bladder.

Our experience with this sling technique is still limited but we are convinced that it can be a relatively simple, safe procedure if tissue dissections are carried out in natural planes of cleavage to avoid troublesome bleeding and the risk of injury to the bladder and urethra. The procedure may fail if the sling is not made sufficiently taut, if the abdominal wall is too relaxed, or if the urethra and vesical neck cannot be freely mobilized on account of dense scar tissue.

In 1948, Millin and Read (1948) reported on the results of Millin's fascial-sling technique for relief of stress incontinence. Aponeurotic fascial straps used for their slings were developed in a way which retained their attachments to the abdominal muscles. Their decision to use a fascial sling as a single suprapubic procedure was based on the conviction that stress incontinence could be cured by proper elevation and support of the vesical neck. They had only one known failure following 140 operations. Their results are remarkable, if the assumption is correct that many women in their series had vaginal birth injuries which were not repaired.

In 1949, Marshall, Marchetti, and Krantz of Cornell reported 82 per cent of cures from their vesico-urethral suspension operation for stress incontinence. By this procedure the urethra and bladder are pulled well forward and upward and fixed to the pubic bone and anterior abdominal wall. The purpose of the operation is to elevate and fix the vesical neck which they regard as essential for urinary control. Their results are excellent in view of the fact that many of their patients had had failures from previous vaginal plastic operations. This is another suprapubic procedure which used alone has produced good results without making further attempts to repair birth injuries to the urethra and bladder.

At a recent meeting of the New York Obstetrical Society, Ball of Cornell reported 94 per cent cures from treatment of stress incontinence by combination of a vaginal plastic of the modified Kelly type, tightening of the vesical neck on its anterior surface, as recommended by Furniss (1925), and fixation of the urethra and vesical neck to the pubic bone and anterior abdominal wall. To facilitate elevation and fixation of the urethra and vesical neck, he recommended that they be freely mobilized by an extensive preliminary dissection similar to that employed by Kennedy for his operation for stress incontinence.

In the treatment of stress incontinence it is interesting to speculate on why vaginal plastic operations used for what appear to be comparable birth injuries may succeed or fail and why sling operations or suprapubic fixations of the urethra and bladder will cure some women in whom vaginal plastic operations have failed. To restore function of the urethral sphincter mechanism it is agreed that the urethra and vesical neck must be supported high in the pelvis. Obviously this can be more positively accomplished by the suprapubic route. Success of the Millin-Read sling technique and the Marshall-Marchetti vesico-urethral suspension operation as single procedures—that is, without preliminary vaginal plastics—serves to emphasize the importance of this step in any surgical technique for relief of stress incontinence.

It seems possible that Jeffcoate has found an explanation for our vaginal plastic failures and for success of the suprapubic procedures. If so, treatment of stress incontinence could be simplified by a vaginal plastic operation which could be depended upon to restore normal angulation between the proximal end of the urethra and the base of the bladder.

On the basis of results obtained, it seems probable that, for the present, vaginal plastic surgery should be the choice for a high percentage of women who have primary stress incontinence. Exceptions might be made for those who have poor development of tissues in and about the urethra and vesical neck and for some who have little or no evidence of abnormalities in so far as these structures are concerned. One of the suprapubic procedures should also be considered for women who have had one or more failures with vaginal plastic surgery.

If it is decided to use a suprapubic operation to treat stress incontinence, it seems logical that it should be combined with a vaginal plastic if the patient has obvious abnormalities which might cause stress incontinence. Mobilization of the urethra and vesical neck by the vaginal route will facilitate elevation and fixation of these structures to the pubic bone and anterior abdominal wall and will reduce the risk of injury

(a)

(b)

(c)

FIG. 1

Lateral cysto-urethrography in a nulliparous woman with normal bladder function.

(*a*) Resting easily with bladder full.

(*b*) Straining.

(*c*) During micturition. Catheter withdrawn from urethra which is outlined by the radio-opaque material being voided. The crenated edge of the posterior bladder wall is indicative of detrusor muscle contractions.

to the urethra during placement of straps to create fascial slings.

The technique of the method recommended by Furniss (1925) to tighten the vesical neck is simple and might increase the success of any of the suprapubic operative procedures.

It will be difficult to develop a well-defined operation for stress incontinence until we acquire exact knowledge as to how urination is controlled. We can hope that the technique of such a procedure can be simpler than some in use at present.

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2. T. N. A. Jeffcoate, M.D., F.R.C.S.(Edin.), F.R.C.O.G.

AND

Henry Roberts, M.D., M.R.C.O.G.

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Stress incontinence of urine in women is a common and embarrassing affliction which is usually attributable, in part at least, to some form of injury sustained during childbirth. Its relationship to vaginal and uterine prolapse is inconstant. Procidentia may occur without any disturbance of bladder control, whereas a woman with a negligible amount of descent of the anterior vaginal wall may dribble urine at the slightest physical effort. Anterior colporrhaphy with its various modifications *permanently* cures stress incontinence in only 60 per cent of cases, although it may improve matters in another 20 per cent; indeed stress incontinence may be caused by what appears to be an anatomically successful operation for prolapse. When anterior colporrhaphy fails, continence can often, but not always, be restored by some form of urethrocystopexy or urethral sling operation. Claims, although possibly less substantial ones, are also made for physiotherapy of various kinds, and for more bizarre types of operative and non-operative treatment. All forms of treatment, however, remain empirical, and their results haphazard and unpredictable, until the anatomical and pathological changes responsible for loss of bladder control are known.

Investigations aimed to elucidate the anatomy and physiology of the female bladder and urethra, and to determine the changes which take place in these organs under various conditions, have been carried out in this department since 1945. The methods employed include naked eye and microscopical examination of tissues obtained at autopsy, cystoscopy, cystometry, and cysto-urethrography, but this communication is mainly concerned with cysto-urethrography in relation to stress incontinence. The comments and conclusions are based on the study of more than 900 X-ray exposures of the bladder and urethra of 132 non-pregnant women.

Cysto-urethrography

This method of examination in the female dates back to Norris and Kimbrough (1928) and its history is reviewed elsewhere (Roberts, 1952).

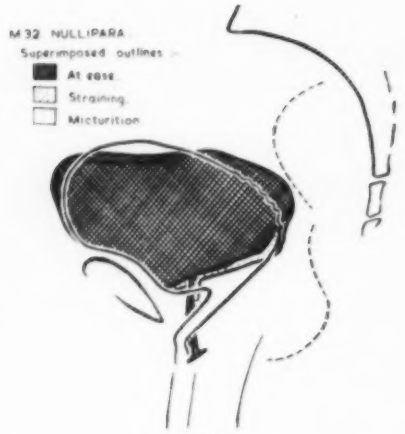


FIG. 2

Superimposed tracings of radiographs in a woman with normal bladder function, showing insignificant changes during stress, but downward movement of the bladder base, obliteration of the posterior urethrovesical angle and dilatation of the urethra during micturition.

Nearly all workers, however, because of technical difficulties, have resorted to antero-posterior and oblique exposures of the urethra and bladder. These views are of limited value, the antero-posterior, for example, showing significant changes in only 50 per cent cases of stress incontinence. In the course of this work we have succeeded in developing a technique for direct lateral cysto-urethrography, the details of which have already been described (Roberts, 1952); this reveals important anatomical changes in 90 per cent of cases. Nevertheless, lateral cysto-urethrography in women is not new; it was carried out with some degree of success by Schubert (1929), while Mikulicz-Radecki described it in 1931 in a remarkable, but little known, account of the anatomical changes associated with stress incontinence and with its surgical treatment.

THE NORMAL BLADDER AND URETHRA

Cysto-urethrography carried out in nulliparous women, and in parous women without prolapse or stress incontinence, gives remarkably constant findings. There were 24 women in this control group.

(a) At rest. When the bladder is full and the patient is standing or sitting quietly, its base (including the trigone and a small area in front of the internal urethral meatus) normally lies parallel with, and 1 to 2 cm. above, a line joining the lower border of the symphysis pubis to the last piece of the sacrum (Figs. 1, 2, 3, 7). The urethra is straight and makes a clearly defined and angled junction with the bladder. There is no suggestion of a "neck" to the bladder. It will be seen later that the posterior urethrovesical angle, which normally measures about 100°, is especially important. The internal urethral meatus is situated 2 to 3 cm. away from the symphysis pubis; indeed the whole urethra is much nearer the centre of the pelvis than is usually supposed.

As seen antero-posteriorly the urethra joins the bladder to make a sharp right angle (Fig. 6).

(b) Under stress. The bladder base and upper urethra normally enjoy a certain degree of mobility, and when the intra-abdominal pressure is raised by strong bearing-down effort they move downwards and backwards to a limited extent (Figs. 1, 2), this movement being more obvious in multiparous women, in whom the displacement is sometimes as much as 1 cm.

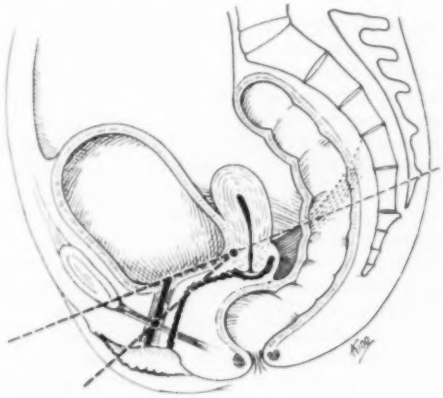


FIG. 3

Diagrammatic representation of the relations of pelvic organs, based on radiographic studies. The two dots indicate fixed points, the lower one being at the level of the triangular ligament. The line joining these points indicates the line of the posterior urethral wall and the trigone of the bladder during micturition.

The relation of the urethra to the bladder, and the shape of the urethrovesical junction, however, are unchanged by stress.

Cysto-urethrograms carried out on all normal controls show that the whole urethra is empty of urine, both at rest and during straining. It has long been established that there is no anatomical sphincter muscle at the internal meatus, but it is nevertheless clear that the obstruction to the outflow of urine is at the internal meatus and not a lower level. This raises the question of the function of the involuntary and voluntary muscles in and around the remainder of the urethra. They probably serve to empty the urethra of urine at the end of micturition, and they also allow interruption of the act at will. It is also possible that they provide a second line of defence against incontinence—not ordinarily required, but ready to be brought into play under severe stress. Urine which forces the upper barrier might then be arrested by the muscular resistance of the urethra itself, and returned to the bladder when the crisis is passed. We have never seen any evidence of this in cysto-urethrograms of normal subjects, although there was a suggestion of it in a few multiparous women whose bladder control was suspect.

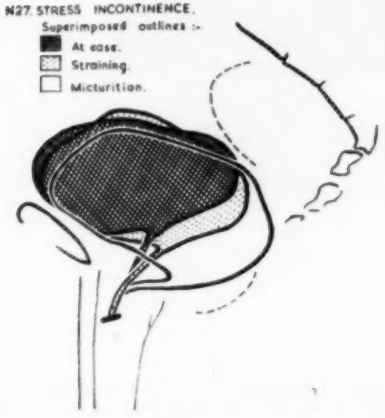


FIG. 4

Superimposed tracings of cysto-urethrographs in a case of moderate prolapse with stress incontinence, showing absence of posterior urethrovesical angle both at rest and during straining.

(c) During micturition. The voluntary and natural evacuation of radio-opaque fluid from the bladder is associated with dramatic and characteristic changes in the X-ray appearances (Figs. 1, 2).

(i) The bladder as a whole becomes more ovoid in shape. This is evidence of detrusor muscle contraction as are the indentations which appear on the posterior bladder wall (Figs. 1*c*, 20*b*).

(ii) The bladder base and the upper urethra move downwards, but the lower urethra remains fixed at the level of the triangular ligament. This movement is more extensive than that seen during other and more forceful bearing-down efforts, and is probably brought about by relaxation of the pelvic floor rather than by the pressure from above.

(iii) Along with this movement the angle normally present between the urethra and the trigone becomes obliterated and both come to lie in a straight line, the internal meatus and upper urethra at the same time assuming a funnel shape.

(iv) The whole urethra, but especially its upper part, becomes somewhat dilated. It runs downwards and forwards in a straight line as far as the lower fixed point, where it is angled in such a way as to direct the stream of urine in a mainly downward direction. This angulation is the result of the increase in slope of the upper movable part of the urethra which, during micturition, lies parallel to the plane of the pelvic brim.

The changes during micturition can be interpreted by assuming two fixed points (Fig. 3), one situated on the anterior aspect of the supravaginal cervix, and one at the level of the compressor urethrae—situated between the layers of the triangular ligament. During micturition the anterior vaginal wall together with the urethra, the posterior lip of the urethrovesical junction and the trigone of the bladder form a straight line between these points. In other circumstances they form an angle. Simultaneous movement of the vagina can be demonstrated radiographically by packing it loosely with a sponge impregnated with barium (Fig. 7).

The Bladder and Urethra in Stress Incontinence

Sixty-seven women complaining of stress incontinence were studied. All but 2 were multiparous, and 12 had gross vaginal or uterovaginal prolapse. Only 4 could be said to have no sagging of the anterior vaginal wall, and the remainder had a minor or moderate degree of urethrocele or cystocele.

It should here be emphasized that great care was taken over the diagnosis of stress incontinence in these cases, and all were subjected to complete investigation, including cystoscopy and cystometry. Frequency of micturition, urgency incontinence, overflow incontinence, chronic cystitis, diverticulae and other lesions of the bladder, and disease of the central nervous system were all excluded—as were cases of temporary stress incontinence occurring during the puerperium. Stress incontinence is frequently misdiagnosed, and as an example we quote 3 cases of Hunner's ulcer of the bladder seen within 2 years, all having already been operated on unsuccessfully for "stress incontinence".

Significant anatomical changes were seen in cysto-urethrograms in all except 2 cases, direct lateral views giving the most striking and constant findings. These are:

(1) Loss of the normal posterior urethrovesical angle so that the base of the bladder and the urethra are in line. This was a feature in 54 out of 67 cases. In two-thirds of these it was present even with the patient at ease; in the others it only became apparent on straining (Figs. 4, 8, 14, 15, 16, 17).

(2) Funnelling of the urethrovesical junction. This is most often merely part of the picture associated with loss of the posterior angle and is, therefore, seen in lateral skiagrams (Figs. 4, 14, 15, 16). In only 4 cases was funnelling of the internal meatus present without a coincident change in the urethrovesical angle. It is in these comparatively rare cases that antero-posterior exposures may reveal funnelling better than lateral ones.

(3) Increased downward movement of the bladder base and rotation of the urethra on straining, and particularly during micturition. This change, however, and except in so far as it is related to loss of the posterior angle, is probably insignificant in that it appears to be related to the degree of prolapse present, rather than to the severity of the incontinence.

(4) In 4 cases in which the shape of the urethrovesical junction was normal, there was a localized herniation of the trigone of the bladder (Fig. 5).

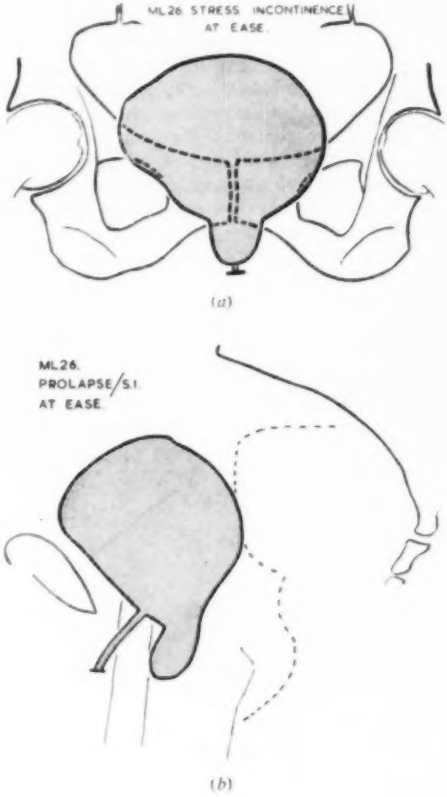


Fig. 5

Tracings of cysto-urethrographs in a woman with a hernia of the trigone causing stress incontinence. This is a rare finding and the only type of prolapse in which incontinence may be present without loss of the posterior urethrovesical angle.

(*a*) Antero-posterior view which might be misinterpreted as showing funnelling of the internal meatus.

(*b*) Lateral view showing true state of affairs.

(*Continued on page* 691

FIG. 6
Antero-posterior cysto-urethrograph in a nulliparous woman with normal bladder function.

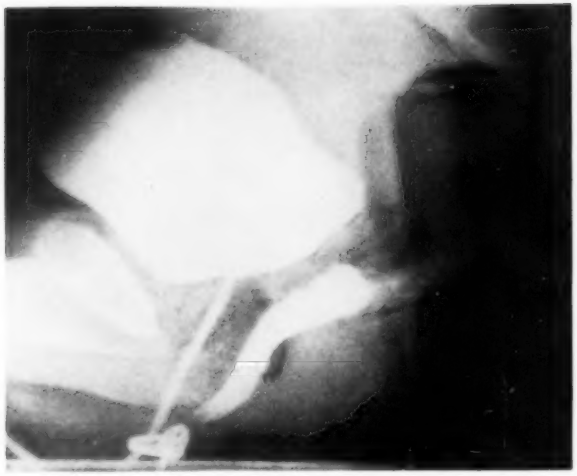


FIG. 7

Normal lateral cysto-urethrograph and colpograph showing the posterior urethrovesical angle and the associated angulation of the vagina. Normal multiparous woman, straining.

(a)

(b)

FIG. 8

Multiparous woman with stress incontinence.

(a) Resting easily. Normal appearances with good posterior angle.

(b) Straining. The posterior urethral angle is lost and radio-opaque material can be seen escaping down the urethra, past the catheter.

FIG. 9

Lateral cysto-urethrograph in a case of utero-vaginal prolapse *without* stress incontinence. Patient straining, posterior urethrovesical angle preserved. This woman suffered from urgency and frequency which was demonstrated to be caused by a Hunner's ulcer.

FIG. 10

Lateral cysto-urethrograph after anterior colporrhaphy for prolapse. Stress incontinence appeared for the first time *after* operation. Note obliteration of the posterior urethrovesical angle. Patient resting easily.

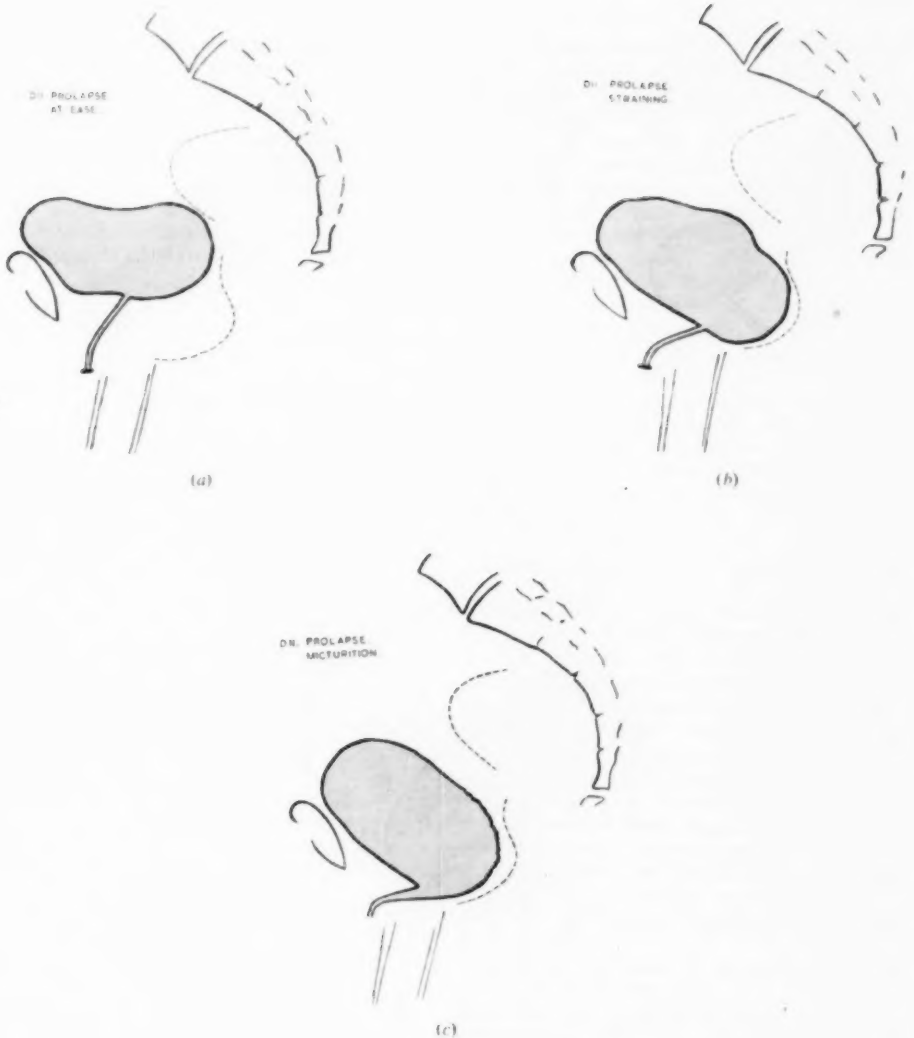


FIG. 11

Tracings from a case of multiparous prolapse *without* stress incontinence.

(*a*) Patient resting easily. Normal except for downward displacement of bladder base and upper urethra.

(*b*) Patient straining. Further descent but posterior urethrovesical angle is preserved.

(*c*) During micturition. Normal appearances.

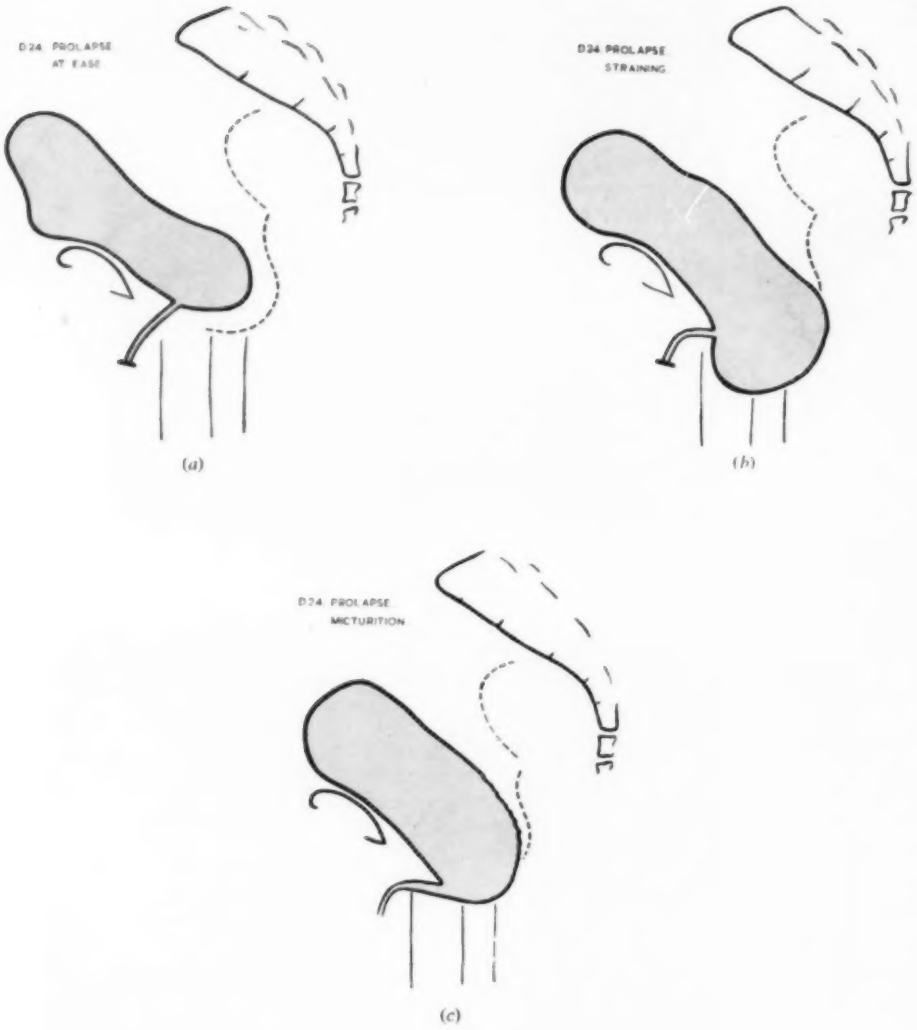


FIG. 12

Tracings from a case of multiparous prolapse *without* stress incontinence.

(*a*) Patient at ease. Normal appearances except for prolapse of bladder and upper urethra.

(*b*) Patient straining. Angle preserved despite gross descent.

(*c*) During micturition. Normal appearances except that bladder is so low that the stream of urine is directed upwards in its earlier course.

(5) In addition to loss of the posterior urethrovesical angle, leakage of bladder fluid into the urethra on straining was seen in 7 cases (Fig. 8).

(6) During micturition the appearances are essentially the same as in normal controls. Indeed, even though the bladder and urethra may be situated at a lower plane in the pelvis and may descend further during straining, the function of micturition is undisturbed in women who suffer stress incontinence (Figs. 4, 15).

If the rather special small group of cases mentioned under (4) above is omitted, it will be seen that the changes in the urethra and bladder under stress are very similar to those which obtain in normal women during micturition.

The Bladder and Urethra in Prolapse without Stress Incontinence

It would be unjustifiable to assume that the above cystographic appearances are significant without comparing them with those found in 23 women who suffered from prolapse without stress incontinence. These are:

(1) Sagging of bladder base and urethra, often with descent to extreme limits on straining, in all cases. These two structures move together, thus tending to preserve their normal relationships, one to the other (Figs. 9, 11, 12, 13).

(2) Preservation of the posterior urethrovesical angle on straining in all except one case. In 2 others, however, the angle was not very pronounced (Figs. 9, 11, 12, 13).

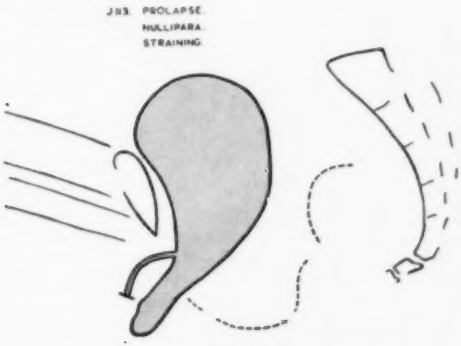


Fig. 13

Nulliparous prolapse *without* stress incontinence. Angle preserved during stress.

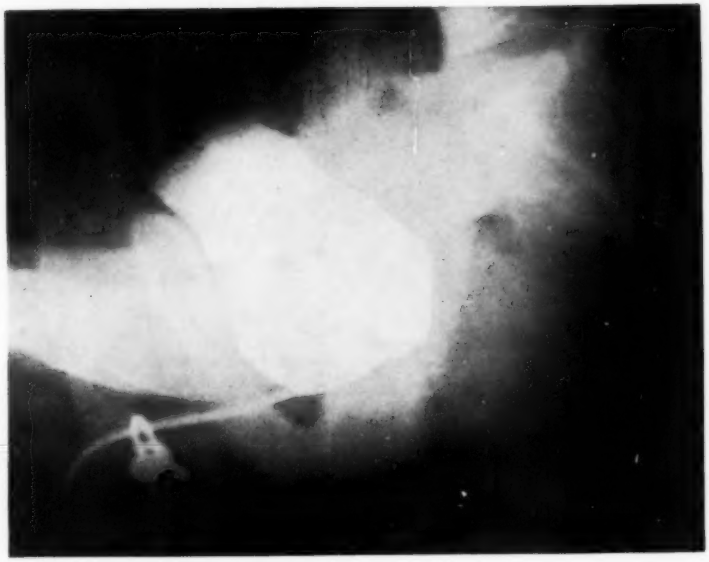
(3) No funnelling of the internal meatus except in one case.

(4) During micturition the appearances are similar to those in normal women except for modification of the slope of the upper urethra by the prolapse (Figs. 11, 12).

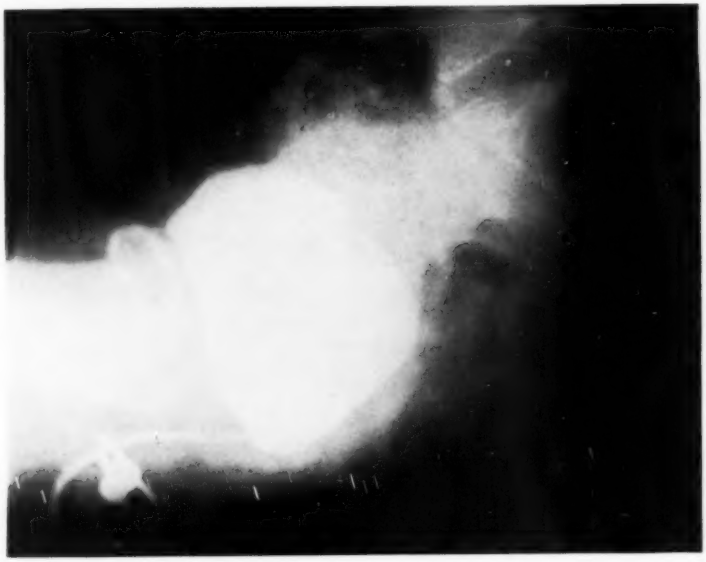
It may be concluded that prolapse without loss of the posterior urethrovesical angle only causes incontinence when it involves the trigone of the bladder as noted above. If the cystocele involves the bladder base behind Mercier's bar, or if the bladder, vagina, and uterus descend *en bloc*, incontinence does not result.

It follows from these observations that continence does not depend on the position of either the urethra or the bladder base themselves, but rather on their relation one to the other, and that the mere correction of a urethrocele or cystocele is inadequate to cure stress incontinence. Moreover, the old and easy explanation of stress incontinence on the basis of dislocation of the urethra from its retropubic position, and its treatment by buttressing the urethra forwards towards the pubes, becomes anatomically unsound. Furthermore, the findings suggest that when stress incontinence *results* from anterior colporrhaphy it is because the anterior vaginal wall is made so tight and straight that it obliterates the posterior angle between bladder base and urethra, and we have evidence of this (Fig. 10). The same explanation may account for the fact that the insertion of too large a size ring pessary for prolapse may cause loss of urinary control. Bonney's pre-operative finger-pressure test at the line of the urethrovesical junction, or the insertion of a Hodge pessary in reverse, gives a positive result in cases of stress incontinence, not because they push the urethra upwards and forwards but because they temporarily reproduce the angle between it and the bladder base (see Fig. 17*b*).

It may at this stage be concluded that any operation which is to cure stress incontinence must aim above all at the restoration of the urethrovesical angle and the correction of any funnelling of the internal meatus which may be present, the former being the more important. This conclusion is strengthened, and the significance of the anatomical changes found in stress incontinence confirmed, by radiological examination of patients before and after operative treatment.



(a)



(b)

(c)

FIG. 15.

Stress incontinence in a multiparous woman.

(a) Patient resting easily with bladder full. The trigone and urethra are in line—the posterior urethrovesical angle being absent.

(b) Patient straining. The bladder base and upper urethra descend, but the main feature is the absence of the posterior urethro-vesical angle.

(c) During micturition, catheter removed. The appearances are normal although there is undue downward displacement of the bladder and upper urethra because of associated prolapse.

The Effect of Vaginal Repair Operations

Cysto-urethrography was carried out before and after anterior colporrhaphy for stress incontinence in 30 women, the studies being repeated at intervals up to 6 months after operation. Although descent of the urethra and bladder base was more or less corrected by anterior colporrhaphy in all except 1 case, the posterior urethrovesical angle and the shape of the internal meatus was restored to normal in only 4 cases (Fig. 14). The appearances were improved in one, worse in 3, and unchanged in the remaining 22 (Fig. 16). All manner of procedures were adopted, including the "Kelly suture" and sutures placed in the sagittal plane after the manner of Royston and Rose (1937), but the few good anatomical results as judged by cysto-urethrography seemed to depend on chance rather than on the particular technique employed. Indeed, we can only conclude that it is extremely difficult, by any of the standard vaginal operations, to restore the urethrovesical angle. And this applies even when the surgeon realizes the deformity present and makes a deliberate attempt to correct it.

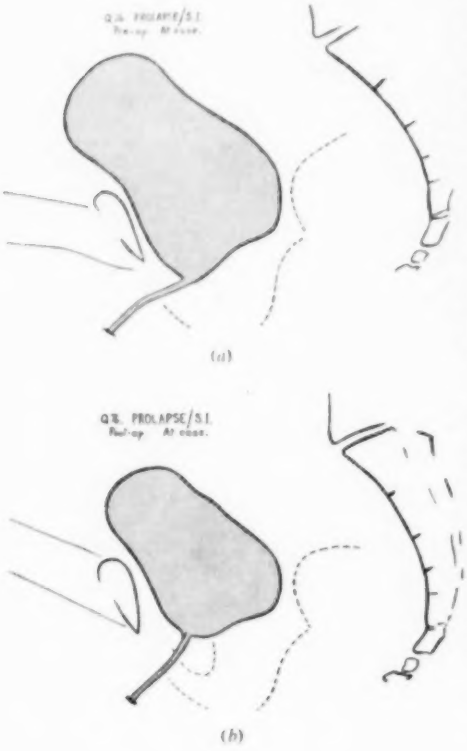


Fig. 14

A case of stress incontinence cured by anterior colporrhaphy.

(*a*) Before operation, posterior urethrovesical angle lost.

(*b*) After operation, posterior urethrovesical angle restored.

It is exceptional to see such a satisfactory anatomical result after anterior colporrhaphy.

The symptomatic results in these cases followed expectations, and 9 out of 30 women reported a continuance or recurrence of incontinence within 6 months of the operation. Others are likely to suffer relapse later. In general, moreover, the symptomatic results tallied with the degree of anatomical success as judged by cysto-urethrography. The 4 women in whom the normal urethrovesical relationship was restored are so far cured of symptoms.

It must not be overlooked, however, that in this small series several women were cured temporarily, and some possibly permanently, of stress incontinence without correction of the posterior urethrovesical angle. How can this be explained? It seems likely that in such cases, and they must be many, the symptomatic success is due to a strengthening of the second line of defence—the voluntary and involuntary muscles and fascia around the urethra itself. This possibility is the real justification for continuing to carry out anterior colporrhaphy as the primary treatment of this condition.

The Effect of Urethral Sling Operations

It is the general experience that some form of urethral sling operation often restores continence even when other types of surgical treatment have failed, but the explanation of the satisfactory results is a matter of theory and dispute. In the course of our investigations the anatomy and function of the urinary apparatus were examined in 25 women subjected to an Aldridge fascial sling operation 1 month to 8 years previously.

Cysto-urethrography in women symptomatically cured by this type of sling operation revealed the following constant features:

(1) Restoration of the posterior urethrovesical angle. Providing this angle is corrected a cure is possible even though some funnelling of the urethrovesical junction persists (Figs. 17, 18, 20).

(2) Elevation of the urethrovesical junction which is prevented from descending too much during straining or micturition. The typical effect of a successful sling operation is shown by the pre-operative and post-operative skiagrams illustrated in Fig. 17.

In the cases in which stress incontinence persisted or recurred after a sling operation, failure to restore the urethrovesical angle was a more constant radiographic feature than failure to correct funnelling of the internal meatus (Fig. 19). The most striking difference between the "cured" and "failed" cases is seen, however, in films taken during micturition. When the operation is successful the sling produces a kink in the upper urethra during micturition—a kink which is not present in other circumstances (Figs. 17, 18, 20). The absence of this deformity in the failed cases suggests that the sling, or the fibrous tissue which replaces it, is too slack, or that it has stretched or broken (Figs. 19, 21).

It should be emphasized that none of the skiagrams showed any evidence that the sling ensures continence by angulating or pulling up the urethra when the patient coughs or strains. It does no more than limit the descent of the urethrovesical junction, and preserve the posterior angle.

The Over-all Results of Sling Operations

Urethral sling operations are more than 40 years old but during the last 10 years many different types and modifications of urethral sling operations have been described, and the literature abounds with enthusiastic claims for their success. There are, however, remarkably few detailed accounts of the results. Risks and complications such as vesical and urethral fistulae, sloughing of the urethra, partial or complete obstruction of the urethra, infection of the retropubic cellular tissue, loss of the micturition reflex, chronic over-distension of the bladder, and chronic cystitis are all mentioned, but there is no clear statement as to how real they are.

Moreover, the results as regards restoration of bladder control, even when given in figures, are not related to the time interval after operation. Sometimes only a few months have elapsed. This is an important consideration because it has long been recognized in regard to other methods of treatment of stress incontinence, and particularly in regard to vaginal plastic operations,

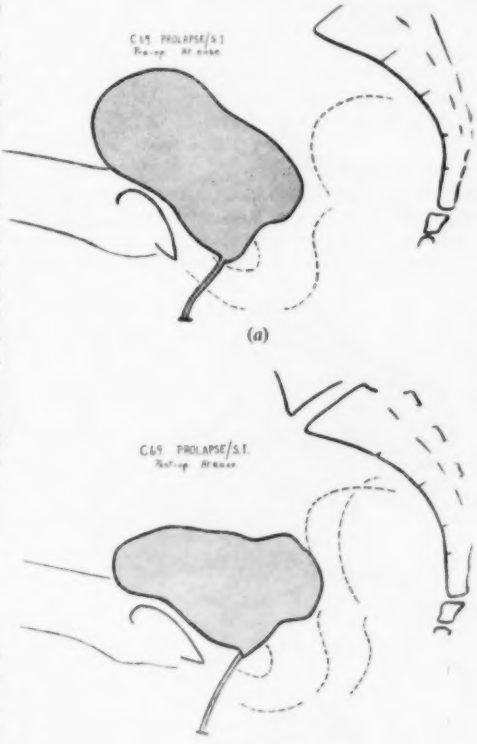


FIG. 16

Prolapse cured but stress incontinence *not* relieved by anterior colporrhaphy.

(*a*) Before operation, posterior urethrovesical angle lost even at rest.

(*b*) After operation, angle not restored, incontinence persists.

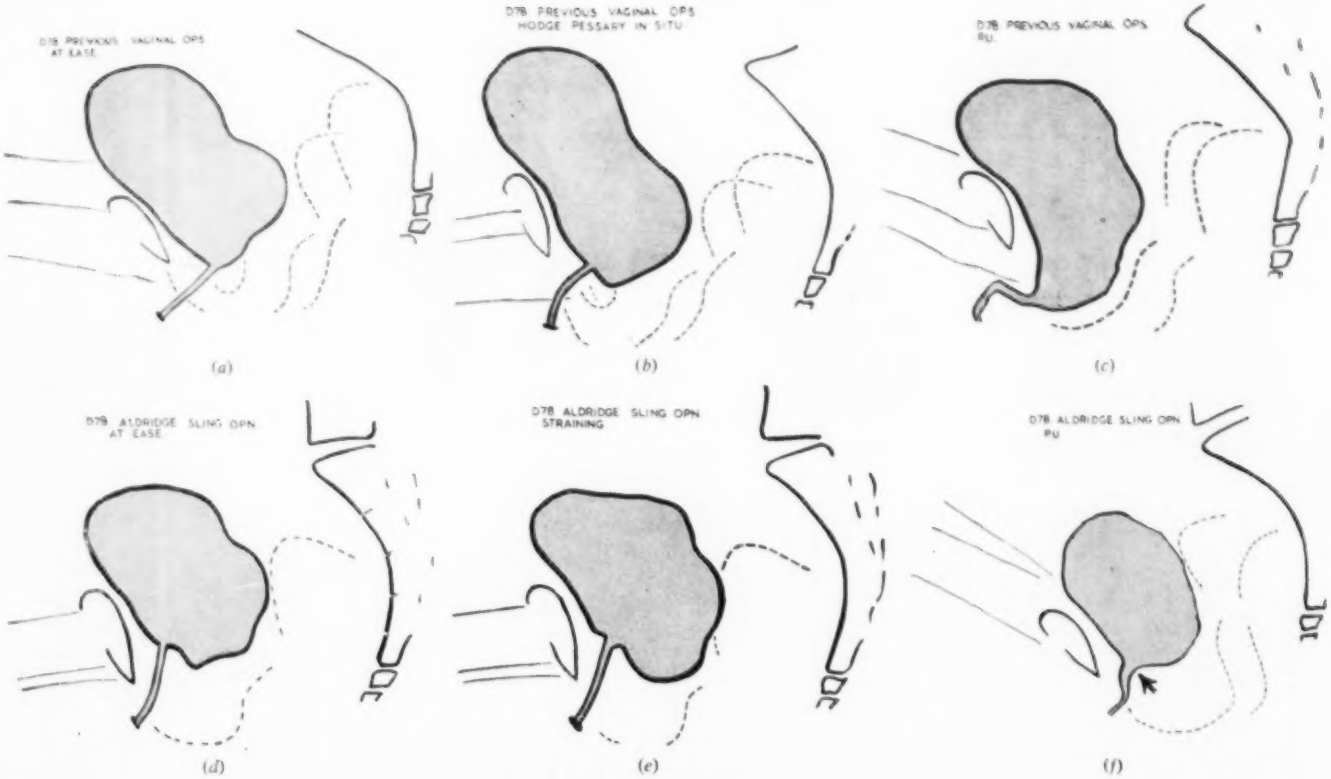


FIG. 17

The effect of a successful Aldridge sling operation for stress incontinence.

(*a*) After previous anterior colporrhaphy, angle obliterated and stress incontinence present. Patient at ease.

(*b*) Hodge pessary inserted with upper bar in front of cervix. Continence temporarily restored because the angle is reproduced.

(*c*) During micturition, before sling operation. Some prolapse still present, appearances otherwise normal.

(*d*) After Aldridge sling operation, patient at ease. The urethrovesical junction is uplifted but more important is the restoration of angle.

(*e*) After operation, patient straining. Still some prolapse of bladder base but the posterior urethrovesical angle is preserved and there is no incontinence.

(*f*) After operation, during micturition. The kink in the urethra, marked by the arrow, indicates the position of the sling. This kink is characteristic of a successful sling operation, but is only seen during micturition.

that the results should not be assessed until at least 2 years after the operation.

We do not propose to discuss the relative merits of the different types of sling operations but merely suggest that the evidence so far available goes to show that:

(1) Good results can probably be obtained by various techniques, providing a sling of good supporting material is placed in the right place.

(2) The sling is best placed after dissection of the bladder base and urethra from below. This ensures a minimum of risk to these organs, allows an attempt* to correct funnelling of the urethral meatus which may be present, and minimizes the risk of the sling being made too tight.

Personal experience is limited to 30 Aldridge fascial sling operations carried out by one of us (T.N.A.J.) and his assistants during 8½ years, the first being performed in January 1944. The small number gives some indication of how few patients among a general gynaecological practice really need the operation. It was advised in every really troublesome case of stress incontinence not cured by anterior colporrhaphy, and only one woman refused it. All except 3 of the 30 patients had had at least one previous unsuccessful vaginal plastic operation.

One patient died from pulmonary embolism on the 6th day, having made good progress until then. Postmortem examination showed that the operation field was satisfactory. All the others made a rapid and uncomplicated recovery. Once, during a demonstration given in unfamiliar surroundings, the urethra was opened during dissection, and in another case an assistant opened the bladder in bringing down a fascial strip. The injuries were immediately repaired, and they healed without difficulty, the ultimate results of the operation being good in both cases. Two patients suffered moderately troublesome postoperative retention for 2 weeks and had at first to adopt an unusual posture (e.g., lying down) in order to empty the bladder. In both, however, micturition was reasonably normal by the time they left hospital. Over-distension of the bladder and loss of the reflex desire to micturate was found one year after operation in 2 women, but responded well to physiotherapy.

The surviving 29 women have all been traced and have been personally observed and studied for periods varying from 1 month to 8 years after operation. In 4 cases the operation was carried out within the last few months, and although the results are all so far satisfactory, it is too early to make any claims for cure. Twenty-five women have been observed for 6 months or longer. If in each case the result had been assessed 6 months postoperatively the findings would have been as follows: cured, 23 cases; improved, 2 cases; failed, 0 cases.

The period of follow-up was at least 2 years in 22 cases. If the results in each of these had been assessed 2 years after operation the findings would have been: cured, 18 cases; improved, 3 cases; failed, 1 case.

In other words, 2 women originally regarded as cured suffered a relapse of symptoms by the end of 2 years. Moreover, our study reveals that incontinence may return at an even later date. One woman had perfect bladder control for 3

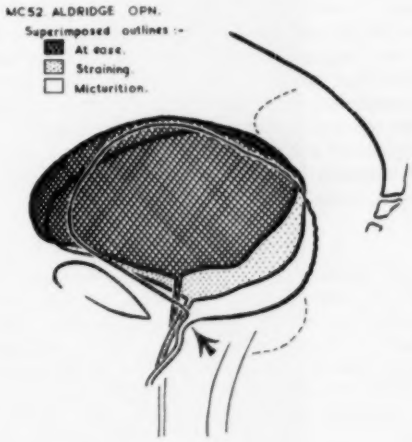


FIG. 18

Superimposed tracings of cysto-urethrographs in a case of stress incontinence successfully treated by an Aldridge sling operation 2½ years previously. Note preservation of the angle on straining and the kink in the urethra during micturition.

* So far, however, we have not found any technique which can be guaranteed to correct funnelling of the internal meatus.

years after operation but then experienced a tearing pain in the left side when lifting a heavy weight, and was thereafter incontinent. Another suffered slight loss of urinary control for a few months 6 years after operation. The total results to date, therefore, based on periods of observation varying from 6 months to 8 years, are as follows: cured, 19 cases; improved, 4 cases; failed, 2 cases.

These figures show what might have been expected, namely that the initial cure rate of approximately 100 per cent for a sling operation falls with the passage of time. They nevertheless indicate that although the end result of an Aldridge operation is not always satisfactory, improvement or cure can be expected in a reasonably high percentage of cases in which other treatments have failed. Moreover, the future outlook in these cases is good because our radiological studies indicate that the urethrovesical relationship is corrected.

Conclusion

This inquiry has so far been restricted to the anatomical and functional results obtained by only 2 methods of treatment—anterior colporrhaphy and the Aldridge sling operation. It is not suggested that other methods may not have their place in the management of stress incontinence. Our findings indicate, however, that the value of any line of treatment, be it surgical or otherwise, may well depend on its effectiveness in restoring the posterior urethrovesical angle.

Summary

All forms of treatment of stress incontinence are empirical, and to some extent unsatisfactory, because the normal anatomy and function of the female urethra and bladder, and the changes responsible for stress incontinence, are unknown.

Normal nulliparous and parous women, cases of prolapse without incontinence, and cases of stress incontinence, both before and after operative treatment, were studied.

The results of repeated cysto-urethrography, and particularly of direct lateral cysto-urethrography, carried out on 132 non-pregnant women are described and interpreted with due regard to the cystometric and cystoscopic findings in the same patients.

The most significant anatomical deformity associated with stress incontinence is loss of the posterior urethrovesical angle. Restoration of this angle is a feature of successful operations for this complaint, correction of funnelling of the internal meatus being of less importance.

Various techniques for supporting the bladder base and upper urethra during anterior colporrhaphy give relatively unsatisfactory results because they rarely correct the significant anatomical deformity. Indeed, anterior colporrhaphy sometimes makes it worse.

The Aldridge fascial sling operation restores the posterior urethrovesical angle and uplifts the urethrovesical junction, but it does not ensure continence by kinking the urethra during stress.

The over-all symptomatic results in a series of 29 Aldridge fascial sling operations are presented. These cases were all personally followed and studied from the time of operation up to date—an interval as long as 8 years in

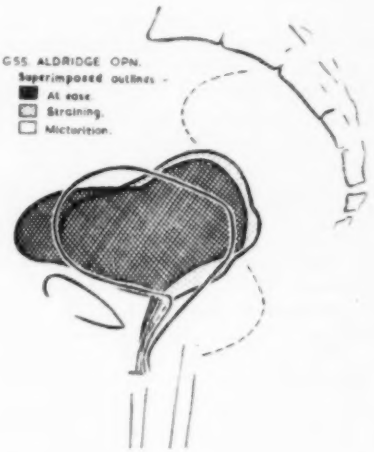
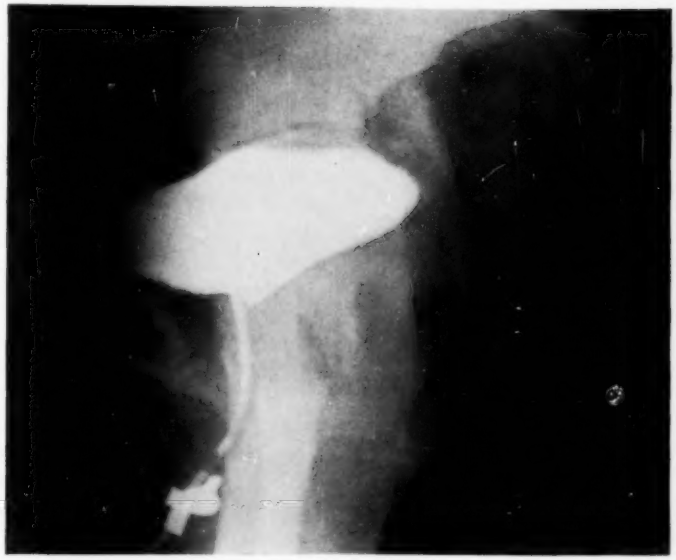


Fig. 19

Superimposed tracings of cysto-urethrographs taken 2 years after an unsuccessful Aldridge sling operation. Patient complaining again of stress incontinence. The posterior urethrovesical angle is not present, either at rest or on straining, and the urethra is not distorted during micturition.



(a)

(b)

FIG. 20

Lateral cysto-urethrographs after a successful Aldridge sling operation.

(a) Patient straining, good posterior angle.

(b) Patient voiding urine. The kink in the urethra is due to the sling, the indentations in the posterior wall of the bladder are indicative of detrusor contractions.

FIG. 21

Lateral cysto-urethrograph during micturition 2 years after an unsuccessful sling operation. Note absence of the kink in the upper urethra.

some cases. If an assessment had been made 6 months after each operation, 23 out of 25 cases would have been graded as cured, and 2 improved. The results, however, deteriorate with the passage of time and relapse may occur as late as 6 years, and possibly longer, after operation. Nevertheless, only 2 cases can so far be regarded as complete failures.

The importance of a clear statement of the risks and complications of various types of sling operation is stressed, as is the need for careful follow-up for at least 2 years before any claim is made for cure.

The stimulus to undertake this work was provided by Mr. Malpas who in 1944 and 1945 carried out preliminary investigations into the movement of the bladder and urethra in labour; he has at all times since given valuable advice and encouragement. The radiological studies were only made possible by the helpful co-operation of Dr. P. H. Whitaker and Dr. E. L. Rubin, and the staffs of their X-ray departments in the Liverpool Royal Infirmary and the Women's Hospital, Liverpool. The expenses were defrayed by a generous grant made by the Research Committee of the Board of Governors of the Liverpool United Teaching Hospitals.

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DISCUSSION

Mr. J. B. Blaikley (London)

It is well recognized that the mechanism by which a woman is able to keep her bladder continent is not clear, but Kennedy (1937) of the Woman's Hospital, New York, by an ingenious method of X-raying the bladder and urethra, has demonstrated what is clinically evident, that sphincter mechanisms exist at the neck of the bladder, in the upper urethra, in the middle urethra, and also at the external meatus, and it would seem that the mechanism at the neck of the bladder is the most important of these.

In stress incontinence the main defect, if not always the only one, is a weakness at the neck of the bladder. Millin has tried to correlate incontinence with descent of the neck on standing, but what seems to matter is not whether the neck descends but whether the sphincter mechanism is thereby rendered inefficient. We are all familiar with the woman with a large cystocele or even complete procidentia who has no trouble at all in " holding her water ". It always seems to me that in the woman with stress incontinence the anterior aspect of the neck of the bladder must be held by its attachments to the pelvic wall, so that on standing, and still more on straining, the descent of the vaginal side tends to drag it open and make incompetent the sphincter mechanism at this site, so allowing urine to pass into the upper urethra.

It is interesting to find that Mulvany and, following him, Gordon Lennon and others have been treating stress incontinence by " vesico-urethrolysis ", i.e. freeing the neck of the bladder from its attachments anteriorly, and one presumes this has happened spontaneously in those cases of cystocele and complete procidentia, in which there is no stress incontinence.

I firmly believe more cases of stress incontinence could be cured by vaginal operation than are in fact cured in this way. The objects of such an operation are to lift up and adequately support the base and neck of the bladder and also to support and narrow the urethra. Too often an inadequate operation is performed. I believe the Manchester operation is capable of curing almost all cases when there is a cystocele, but that it is necessary not only to amputate the cervix but to make a wide excision of the mucosa in the vaginal vault, so exposing the tissues lateral to the vagina. In those cases of stress incontinence in which there is no cystocele and no descent of the uterus it is still pos-

sible to make a fairly wide excision of mucosa in the upper vagina and to get at the cardinal ligaments, though amputation of the cervix is, of course, most helpful in making this possible. Not only are Mackenrodt's ligaments sutured together in front of the cervix, but the so-called pubo-cervical fascia from either side is brought together below the bladder. This structure, never recognized by the anatomists, is really part of the cardinal ligaments, and so it is only by going lateral to the vagina that good firm tissue is found. The only definite structures of this sort in the axis of the vagina are in fact the cardinal ligaments, which are, of course, continuous with Mackenrodt's ligaments. Unless the cervix is amputated it is difficult to get at these ligaments and difficult to get properly started on building up a shelf to support the bladder.

The cardinal ligaments are attached to the lateral aspects of the vagina in its upper half or two-thirds, and are attached laterally to the side walls of the pelvis. It is possible when the repair of the anterior vaginal wall is half completed to pass a finger in front of the so-called pubo-cervical fascia and demonstrate the lateral attachments to the pelvic walls commencing in the region of the ischial spines and passing downwards and forwards. Microscopical sections of tissue removed from these structures show that they contain a large amount of plain muscle, at least in women before the menopause.

Pacey has described a sling formed by the pubo-coccygeus around the urethra, but this can only be a small thing at the level of the pelvic floor, much lower down than he shows in his diagrams, and is not comparable with the structures I have been describing which are familiar to most of you.

I strongly advocate the Manchester operation with wide excision of the vaginal vault. If this is done, only very seldom indeed does one fail to cure stress incontinence, and only very seldom does a sling operation become necessary. A sling should *never* be used except after the correction of any prolapse, for if used to give support it is likely to cut through the urethra and give rise to a fistula. The function of a sling is slightly to kink the upper urethra, not to support it. Admittedly there are cases which have to have sling operations: usually those in which there is no prolapse but a defect of the nervous mechanism, and vaginal operation has failed. In those few cases in which I have performed a sling operation I have had very satisfactory results, but as a rule I have found it possible to cure a woman who has had a previous vaginal repair by doing another Manchester repair operation.

My belief is that greater success in the cure of stress incontinence is possible with vaginal repair operations, but that it is necessary to make a more extensive repair in the upper part of the anterior vaginal wall than is customarily done by many surgeons.

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Dr. John R. Upton (San Francisco)

Urinary stress incontinence is encountered in all age groups of women, but this distressing and humiliating condition is most frequently found in multiparous women approaching the menopause or in the postmenopausal stage. My remarks will be limited to a specific type of urinary stress incontinence associated with a marked decensus of the uterus and a cysto-urethro-rectocele encountered in women over 70 years of age.

During the last 3 months 2 women presented themselves for treatment. One was 72 years of age; her only symptoms were an involuntary leakage of urine on laughing, and the presence of a "growth" between the legs. The other patient was 78 years of age and her symptoms were identical with those of the first woman. There was no complaint of dysuria. Both patients showed marked signs of hypertensive heart disease, a moderate proteinuria, generalized signs of ageing, and extensive bilateral thigh and leg varicosities. The first patient still retained her tiny atrophic uterus; the other had sustained supracervical hysterectomy 35 years previously. Both cervices were clean, tiny and healthy. The vaginal relaxation and general physical condition were strikingly

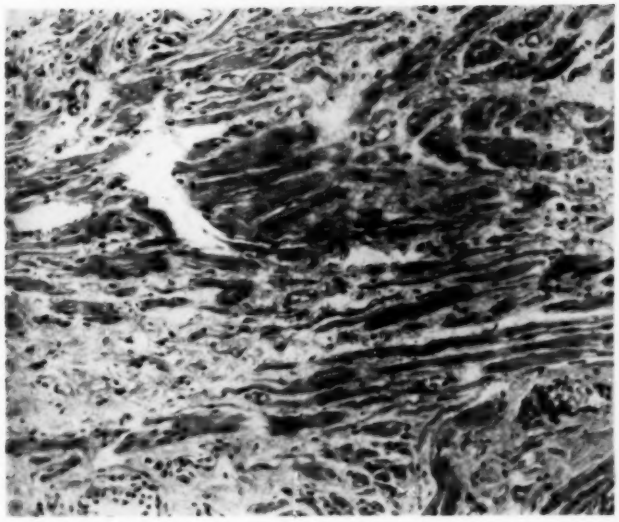


FIG. 1
Pubo-cervical fascia showing plain muscle. × 120

similar and both patients were extremely poor operative risks.

A modified Le Fort type of operation was performed on these two women; they came through the operation quite nicely, and to date, fortunately, their identical symptoms have been corrected.

I mention the Le Fort type of procedure because it appears to have fallen into some disuse. However, if used in patients presenting such marked degenerative bodily changes as I have illustrated, the operation works extremely well. I cannot agree with those who claim the operation is a " defeatist type " of procedure or that the performance of such an operation is an admission by the surgeon of his inability to cure the prolapse and leave a functioning vagina. I am quite convinced that in a few selected instances, the Neugebauer–Le-Fort operation is definitely indicated and its results might well be re-assessed.

Leon Le Fort, reporting the original operation in 1877, only stressed the denudation of a narrow strip of the anterior and posterior vaginal mucosa with the re-approximation of the denuded areas. The result of this operation was a partial closure of the vaginal canal leaving a bilateral vaginal sulcus. I have often thought that the inspiration for the development of the Le Fort operation was derived from observing congenital septate vaginae.

In 1947, Robert Tauber, writing in *The Annals of Surgery*, brought up to date the then current thought and reported it in a paper entitled " The Modern Technic of the Le Fort Operation ". McElin and Blackwell have recently reported their experiences in 15 cases, and they also reviewed the pros and cons of the operation.

I have only used the Le Fort operation 7 times in the last 15 years. The results obtained have justified my decision. In 3 of my 7 patients I modified the prevalent technique of performing the Le Fort operation in order to correct the urethrocele and the attendant stress incontinence. This method corrects the prolapsed urethra and bladder neck. The usual method is to suture the posterior and anterior denuded vaginal surfaces together, terminating the anterior closure approximately 1 to 2 cm. below the external urethral opening. This technique will not correct a urethrocele, for the urethrocele is often made worse by tension or by dragging of the newly apposed sutured surfaces. When the vagina is inrolled down to the level of the vesical sphincter I make use of the Kelly plication stitch to buttress lateral tissue under the sphincter and urethra. Usually 3 such plicating sutures are sufficient to elevate and support the bladder sphincter and urethra. Double 0 chromic sutures and not silk are used for the entire operation. I consider this modification of prime importance if we expect the Le Fort operation to correct a urethrocystocele and the distressing symptom of stress incontinence in elderly women.

The Le Fort or subtotal colpocleisis operation is finished by performing a regular perineorrhaphy. A catheter is inserted into the bladder and remains there for an average of 3 days. Early ambulation is stressed. My patients are up and take a few steps within 24 hours. When leg varicosities are present the legs are wrapped from the ankle to the mid-thigh before they leave the surgery. These slight restrictive bandages are re-applied every day for the patient's comfort, and to prevent inadvertent constrictions developing.

In carefully selected patients suffering from stress incontinence, the modified Le Fort operation has been of real assistance. I shall continue to use it.

DR. A. INGELMAN-SUNDBERG (Stockholm)

THIS report only deals with my own material and operative technique. Concerning the theory of my operations and other methods of treatment reference is made to the paper I published in 1952(a).

Aetiology

The aetiology of stress incontinence is not uniform, and the various causes of incontinence give a natural classification.

It was shown by Ingelman-Sundberg (1946, 1947), Millin and Read (1948), and Muellner (1949), independently of each other, that the physiological descent of the bladder neck during micturition took place to an abnormal extent in

cases of typical stress incontinence. During straining the same phenomenon is seen, and eventually there is an abnormal funnelling of the bladder neck. This is due to an insufficiency of the pelvic floor, especially of the pubococcygeal muscles.

Some cases of stress incontinence develop after pelvic surgery, usually operations for prolapse. During urethroscopy I find that in these cases the internal urethral meatus has an abnormal shape, and is unable to close normally due to fixation by scar tissue.

In 5 cases of urinary incontinence since childhood I have found a very wide posterior urethra when they were examined radiologically during micturition. The cause of the incontinence in these cases is probably a congenital hypoplasia of the internal sphincter.

In a few cases stress incontinence is due to urethral diverticula or inflammation of the posterior urethral glands.

Neurogenic disturbances are not infrequently combined with an insufficiency of the pelvic floor, due to the fact that women suffering from nervous disease have often borne children, and sometimes the nerve lesion *per se* causes a paralysis of the muscles of the pelvic floor or of the urethral sphincter. Among the patients suffering from stress incontinence there are, therefore, also some cases with a non-spastic neurogenic bladder.

Diagnosis

An exact diagnosis is very important, and no operative treatment should be instituted until the diagnosis is as certain as possible.

The anamnesis gives some information. A case of stress incontinence is always continent in the lying or sitting position, and does not suffer from urgency. Usually she has borne children, but some nulliparae develop an insufficiency of the pelvic floor during the menopause.

In cases of " scar incontinence " the disability commences shortly after the operation, and patients with congenital weakness of the urethral sphincter lack urinary control from childhood.

Burning pain is often complained of in cases with infected urethral glands or diverticula, and women with diverticula sometimes complain of coital leakage and dribbling after micturition. They may also complain of typical stress incontinence, as the inflammation may lead to defective function of the sphincter.

Examination by X-rays is performed in all cases. We use a technique developed by Nordenström (1952). Barium meal in water suspension 1:3 by weight is used, and the patient is examined in frontal and lateral positions. Exposures are made in the attitudes of " rest ", " micturition ", and " hold ". The frontal position gives information concerning the shape of the bladder and the funnelling of its neck. For studies of ptosis and the shape of the urethra the lateral position is very valuable, as it makes exact measurements possible concerning the relation of the bladder neck to the symphysis, and gives an excellent view of the urethra in its whole length. After the examination the contrast medium must be carefully rinsed out.

A brief neurological examination must be made, including special investigations when indicated. I have found the sensitivity of the bladder of special importance. Lack of sensitivity in some part of the bladder is sometimes the only objective sign of a neurogenic bladder lesion. The examination is carried out by the tip of the cystoscope. The patient can normally state precisely whether the touch is made on the left or right side or in the middle of the bladder floor. Some patients lack sensitivity on one side of the midline, while in others circumscribed areas are found which are devoid of the sense of localization.

Urethroscopy is important. Inflammation of the posterior urethra and diverticula are especially looked for, and the shape and movements of the internal meatus are studied during an effort to micturate and during " hold ".

The cystometry curve must be studied. We make a continuous record of the pressure in the bladder, using a double Foley catheter and a kymograph. The bladder is filled slowly with water through the fine canula, and the pressure in the bladder is registered through the thick tube. The first desire, capacity, initiation, and pressure during an effort to micturate are registered. The detrusor activity is observed on the registered curve, and uncontrolled contractions can be easily diagnosed. The slope of the curve gives the tonus of the bladder.

The sphincter pressure is measured by use of a glass tube with a cone at the end which is placed against the external urethral meatus of the recumbent patient after the bladder has been emptied. The other end of the glass tube is connected through a soft rubber tube to a glass funnel. The system is filled with water, and the funnel is raised until the water runs into the bladder. The height of the fluid surface in the funnel over the external urethral meatus at that moment gives the pressure necessary to open the sphincters. The pressure is recorded during relaxation (chiefly involuntary sphincter) and during "hold" (voluntary and involuntary sphincters). The normal pressure found with our method varies, but is usually 20–50 cm. during relaxation and 30–70 cm. of water during "hold". In cases of "scar incontinence" the sphincter pressure is very low, often less than 10 cm.

Therapy

Three operations are used with different indications:

(1) My plastic repair of the pelvic floor, where the anterior portions of the divided pubococcygeus muscles are used for the suspension of the bladder neck in order to overcome the tendency to recurrence associated with operations using only connective tissue for the replacement of the bladder (Ingelman-Sundberg, 1946, 1947, 1952b). The standard technique is seen in Fig. 4.

(2) Instead of lifting the bladder neck, I suggested dividing the pubovesical ligaments, and mobilizing the bladder neck from the posterior surface of the symphysis with the finger or a sponge (Ingelman-Sundberg, 1949). The technique is seen in Fig. 3. The same operation has at a later date been used by Mulvany (1951).

(3) "The urethra-kinking operation" (Ingelman-Sundberg, 1951). This operation is demonstrated in Fig. 1.

Indications for Surgery

If conservative treatment has failed operation has been recommended. However, patients suffering from hypertonic or uninhibited neurogenic bladders are not cured by any of these operations, and must be excluded.

Cases, in which an insufficiency of the pelvic floor is demonstrated, are routinely operated on according to the first method (Fig. 4). In selected cases, i.e. those in poor general health the operation shown in Fig. 3 is performed, as it takes only 5–10 minutes to complete.

Patients suffering from an insufficiency of the pelvic floor in combination with a non-spastic neurogenic bladder are first operated on by the method shown in Fig. 4. If cure does not ensue, the urethra-kinking operation of Fig. 1 is added.

Cases of stress incontinence with neurogenic disturbances causing a non-spastic neurogenic bladder and without insufficiency of the pelvic floor are operated on by the third method.

In cases of urethral diverticula extirpation is first performed followed by the operation illustrated in Fig. 4.

Cases of "scar incontinence" are treated by the third method.

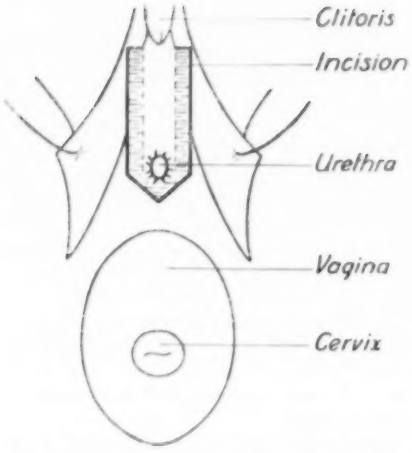
If the cervix is enlarged or descended either an amputation of the cervix or hysterectomy is added.

Results

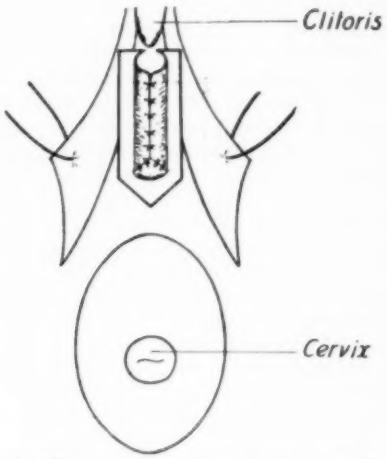
Eighty-three cases of severe stress incontinence with insufficiency of the pelvic floor have been operated on by the first method. Twenty of these patients had had previous unsuccessful operations, including sling operations in 4 cases. Seventy-eight were completely cured, and 5 greatly improved, only having slight incontinence on coughing and sneezing. Thirty patients have been observed for 6–7 years, 8 for 5 years, 11 for 3 years, and the rest for 2 years or less. No recurrences have occurred in spite of the fact that 4 women have had 1 or 2 deliveries since the operation.

Thirteen cases of stress incontinence with insufficiency of the pelvic floor have been operated on by the second method. Ten have been cured, and 2 greatly improved. One patient, who was only slightly improved has since been cured after operation by the first method. One of the patients has been observed for 3½ years, 1 for 3 years, and the rest for 2 years or less. One woman had a normal delivery 1 year after the operation. No recurrences have occurred.

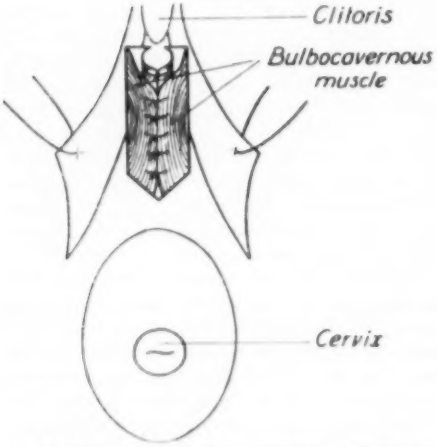
Seven cases of urethral diverticula have all been cured after extirpation or extirpation and operation according to the first method. The



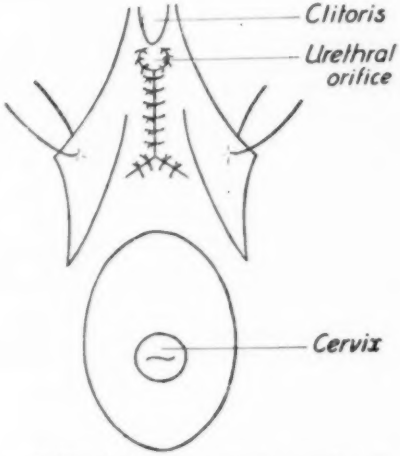
(*a*) The mucous membrane corresponding to the hatched area is freed.



(*b*) The mucous membrane is then sutured as a tube 4–5 cm. in length, and with a circumference measuring about 3 cm.



(*c*) The mucous tube is covered with the bulbocavernosus muscle and the adipose tissue of the labia majora.



(*d*) The incision is sutured according to the diagram, and a Foley catheter is left in place for at least a week.

FIG. 1
The "urethra-kinking" operation.

time of observation ranges from 6 months to 7 years.

Two cases of incontinence following the Manchester operation have been cured by the third method. Four cases suffering from incontinence after vesicovaginal fistulae had been closed, and the 5 cases of congenital weakness of the internal sphincter previously mentioned, and 3 cases of a non-spastic neurogenic bladder have also been cured by the same type of operation. Two patients suffering from insufficiency of the pelvic floor together with a non-spastic neurogenic bladder have been cured by the combined use of methods 1 and 3. No recurrences have occurred, the time of observation varying between 6 months and 3½ years.

Summary

My methods for diagnosis and operative treatment of stress incontinence of urine are described, and a follow-up is presented of 119 cases treated by operation.

Addendum

I think that we are now going to solve the problem of stress incontinence. But as our diagnostic methods improve we find more neurogenic bladders. For the treatment of the hypertonic and the uninhibited neurogenic bladder we have not, up to now, had any suitable method.

In these patients I have tried to resect the inferior hypogastric plexus according to Fig. 2, from a vaginal incision. Ten patients have been operated on. In 2 cases the resection was bilateral, and in the other 8 patients unilateral. All were primarily cured, and there was no difference of the primary results. One patient, however, developed some retention after resection on one side, and has to take carbacholine

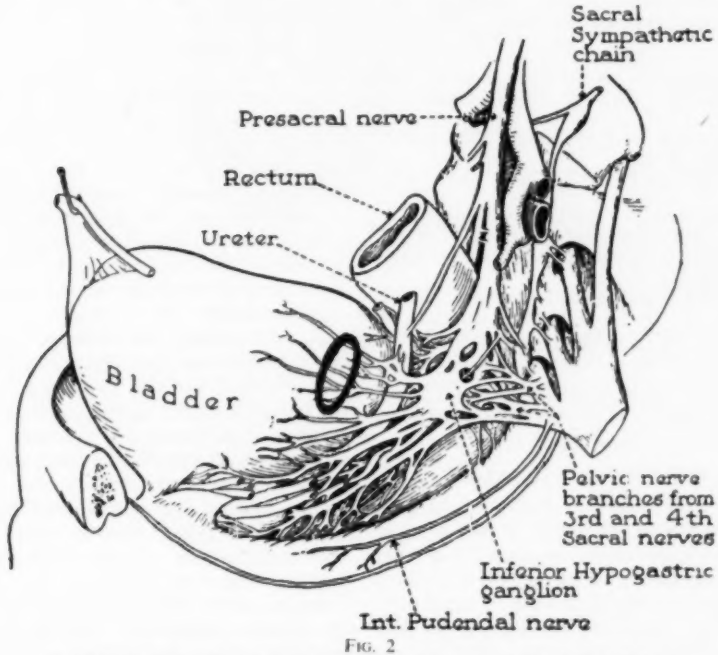


FIG. 2

Anatomical drawing showing the lateral aspect of the left inferior hypogastric ganglion. (After Laterjet and Bonnet.) The nerves within the black circle are extirpated on one or both sides.

in order to empty the bladder. One of the bilateral cases is still free from symptoms 2 years after the operation. The other one was completely cured for 3 months. After that the cystometry curve began to show some spikes, and she had to micturate more frequently. Two years after the resection she is, however, still much better than before the operation, and can sometimes hold the urine for 8 hours, and she has no painful tenesmus. Two of the cases in which unilateral resection was performed are free from symptoms 22 and 14 months after the operation. Three unilateral cases operated on during the last 6 months are also still free from symptoms. One patient after unilateral resection had no complaints for 2 months, but after 3 months she had the same painful urgency as before. The other 2 cases were completely cured for 2 months. After that they had to micturate more frequently, but the painful urgency is still absent 20 and 12 months afterwards, so they feel much improved.

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DR. HENRY ROBERTS (Liverpool)

PROFESSOR JEFFCOATE has shown radiological pictures illustrating the effects of two types of operation for stress incontinence and has emphasized the importance of the posterior urethrovesical angle in ensuring control of the female bladder. Since that work was carried out, and during the last few weeks, we have had an opportunity of using the same technique for studying the effect of the Marshall-Marchetti urethrocystopexy carried out on 3 patients. The findings are again consistent and confirm our previous conclusions about the anatomical changes associated with the cause and cure of stress incontinence.

In regard to this operation, as in others, many writers have shown antero-posterior radiographs which purport to show that the good results obtained are due to uplifting the urethrovesical junction and displacing it forwards. Lateral cysto-urethrography, however, again shows that such uplift is of no consequence, and indeed is not always present even in cured cases. Moreover the secret of this operation, like others, is not the correction of funnelling of the internal meatus. The explanation of restoration of bladder control is essentially the restoration of the posterior urethrovesical angle.

The first case did not have very severe stress incontinence, but the obliteration of the angle is clearly shown before operation. Radiographs taken 3 weeks after operation show a good angle even when the patient strains.

One of the interesting features is that this operation restricts the movement of the urethrovesical junction to the extent that the angle does not even disappear completely during micturition. Indeed, the urethra even looks a little kinked, as it does following a sling operation.

The other two cases were examined 8 and 9 months respectively after a clinically successful operation carried out by Mr. Hamilton. Again the striking feature is the restoration of the angle —not the uplift of the bladder.

So far, therefore, our evidence goes to show that the Marchetti operation, like other successful operations, achieves its objects by restoring the posterior urethrovesical angle. This finding justifies its continued use although it has still to be demonstrated that its effect will be maintained over the course of years. More important, the radiological evidence reported here, if it is confirmed by examination of further cases, has wide implications so far as knowledge of anatomy and function goes. The suggestion being, of course, that the angle is dependent on the intrinsic musculature around the bladder base and urethra, rather than on the accessory voluntary muscles or pelvic fascia which in this operation are neither disturbed nor sutured.

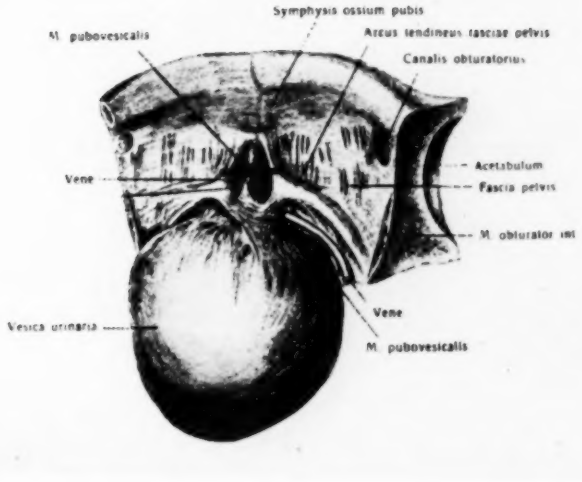
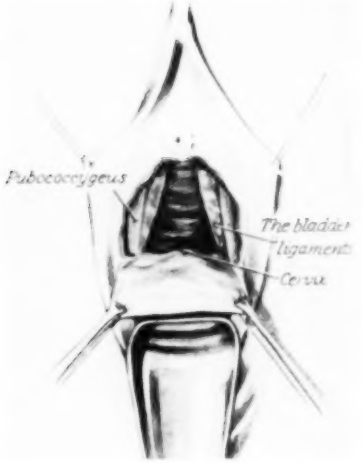


FIG. 3

Dividing the pubovesical ligaments.

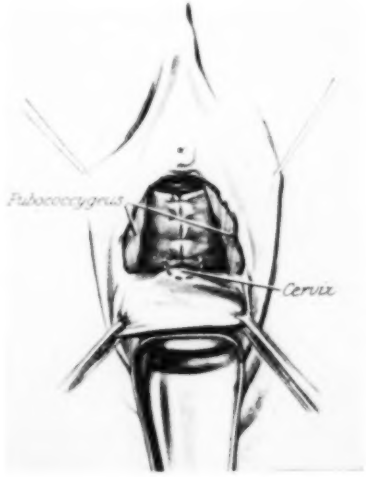
The bladder is filled from a Foley catheter left in place during the operation. The bladder neck is then easily located extraperitoneally from a small median incision above the symphysis. The pubovesical and pubo-urethral tissue is separated from the symphysis along the black line of the figure with the finger or a sponge. After haemostasis is effected the wound is closed. The patient is allowed to leave bed the next day, and can be discharged from the hospital in 5–7 days.

(*a*) Local anaesthesia. A transverse incision is made under the external urethral meatus.



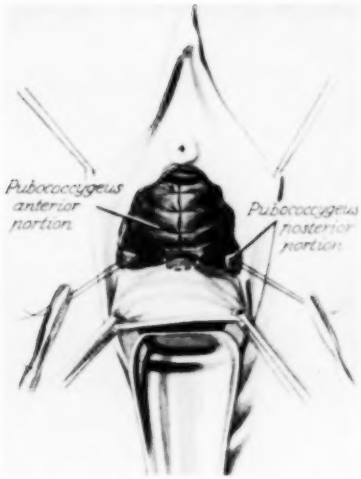
(*b*) The anterior vaginal wall is dissected from the urethra and from the bladder, by knife and small sponges, up to the cervix.

(*c*) The bladder ligaments are laid free as far as possible to the sides and sutured under the neck and the floor of the bladder, which is brought back to its normal position.

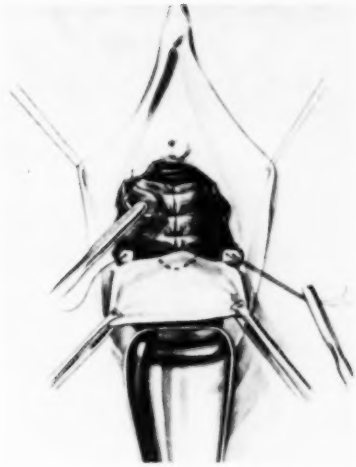


(*d*) By blunt dissection laterally the pubococcygeus muscles are laid free, and cut slightly behind the midpoint.

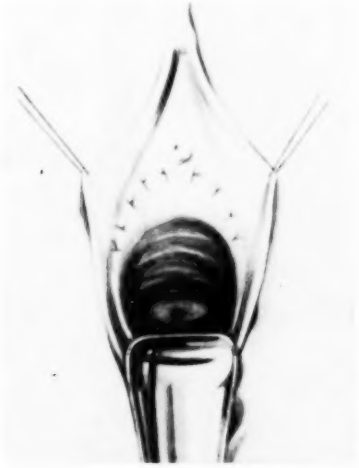
FIG. 4
Plastic repair of the pelvic floor



(e) The anterior pubococcygeus portions are fixed together by interrupted sutures to form a muscular support for the bladder neck under the fascial layer.



(f) The posterior pubococcygeus portions are fixed laterally.



(g) The anterior vaginal wall is sutured to the muscular plate with a few stitches, and the incision is closed.

FIG. 4 *(continued)*

Dr. G. F. Paap (Long Beach, California)

I deem it a great pleasure to discuss the papers presented by Drs. Aldridge and Jeffcoate on stress incontinence of urine in the female. I feel very humble in doing so before such an array of accomplished surgeons who have contributed so much to this distressing problem.

All operative procedures prior to the advent of the combined technique have been directed towards the mobilization and re-approximation of the pubocervical fascia and the sphincter urethrae muscle, viz., the Kelly stitch, the Kennedy operation, even the old procedure devised by Douglas in 1905. Two things were accomplished by this operation: (1) the approximation of the fascial planes of the trigone and the pubocervical fascia; (2) the approximation of the sphincter fibres or musculofascial bundles of the urethra to the posterior aspect of the symphysis pubis. This procedure resulted in as high as 20 per cent and as low as 7 per cent failures with a higher incidence of failure by re-operation with a similar procedure. Dr. Aldridge has added greatly to the success of the perineal repair procedure by using the combined operation with fascial strips. Since 1945 we have successfully operated on 14 cases, using the Aldridge technique with the modifications advanced by Dr. Studdeford. To date all of these 14 cases have had excellent results with good bladder control. There have been no complications, all patients have recovered and have been afebrile on the 5th day. Their postoperative inability to void was a variable one, extending from 3 days to 2 weeks. In 2 of these patients the original difficulty in starting the stream persists, and they have made the discovery that if they void in a stooping position, relaxing the anterior abdominal recti muscles, they can overcome this difficulty. In the last 4 cases that we have done, we have added a little variation which allows for one operator and one assistant. The perineal work is completed below as usual, except that we use two 1-inch Penrose drains 12 inches long, previously tested for strength. They are inserted with uterine forceps through the pubovesical fascia on each side of the urethra, to the space of Retzius. The perineal work is then completed. The operator then shifts to the abdomen, prepares the fascial strips from the rectus sheath, opens the space of Retzius, recovers the ends of the Penrose drains, and injects water through them in order to determine which ends are to be used in fastening the fascia. The fascial strips are then pulled through from opposite sides and sutured to the lower margin of the aponeurosis of the rectus muscle with interrupted cotton sutures. We have found that this technique shortens the length of the operation and allows for two operators and greater ease in draping the patient.

In summarizing the operative criteria for the combined type of operation, we feel that these patients should be parous women. They should be selected on the basis of a very severe type of stress incontinence with or without cystocele. They may or may not have been previously operated on. Age we feel is no criterion. We also feel that in the simpler cases of stress incontinence in younger women, the Kegel technique of exercising the pubococcygeus muscle is important and where this fails, surgery should be performed. We feel that serious consideration should be given to the problem of delivering subsequent pregnancies, whether from below or by Caesarean section, in all patients who have been successfully operated on for stress incontinence of urine. We have found that if cases are properly selected this combined type of operation proves effective in correcting stress incontinence of urine.

Mr. Leonard Phillips (London)

I feel very diffident in expressing my views, but after listening to Professor Jeffcoate's original and very valuable contribution, I find I must scrap the remarks I had prepared and re-orientate my views to some extent.

I have found the many operations designed to deal with stress incontinence after failure of vaginal plastic operations very confusing because, although apparently successful, they have seemed to be based on entirely opposite conceptions of the anatomy and pathology of the subject. Some claim success from pulling forward the urethro-vesical junction by slings, or by stitching it to the back of the symphysis pubis, while others, like Mr. Mulvany and Professor

Lennon, claim equal success from freeing this area anteriorly and letting it down. Then, too, some claim that sepsis and fibrosis following vaginal operations offer a guarantee of cure of stress incontinence—while others maintain that stress incontinence occurs as the result of extensive fibrosis, and is the most difficult type of case to cure.

Now that we have heard Professor Jeffcoate's paper, I think we may be able to supply the answers to these problems in a year or two, and that all these apparently conflicting views will fall into line when it is realized that it is a question of restoring the correct posterior urethrovesical angle, and approximating it to a right angle. This may be effected either by letting down the vesico-urethral junction in some cases or pulling it forward in others. The difficulty will be in knowing when we have produced approximately the right angle, and it seems as though we will have to do cystographies before and after our operations.

I would, however, like to emphasize that it is not necessary to have a failure rate of 20 per cent after vaginal operations for stress incontinence, as stated by Dr. Aldridge, or even of 10 per cent, a figure quoted by some of my colleagues. I thought I had cured all my stress incontinence cases by a vaginal repair operation, but since the frequency of recurrence has been stressed in the literature, I have followed up my own cases for the last 6 years. I find that during this period I have had to perform 12 sling operations (6 on my own failures), mostly of the Aldridge type, which were all successful except one. This means 6 recurrences in about 1,800 vaginal repair operations, more than half of which complained of stress incontinence, or a failure rate of less than 1 per cent.

I would like to emphasize the following technical points:

(1) A great responsibility attaches to the person who does the first operation. If this fails, it may be difficult to effect a cure, sometimes very difficult. We should not, therefore, delegate these operations to residents and trainees, unless they have been well supervised and trained in the performance of the operation.

(2) The operation should not be hurried or casual. Failure can often be traced to hurry at the end of a list, or to the desire to get away to other work. The surgeon should be prepared to sit down and do the operation as slowly and carefully as though he were doing an operation for a difficult vesicovaginal fistula.

(3) Great help can be obtained in these operations if the vaginal sub-mucosa is injected with 10 ml. of a 1 in 100,000 solution of adrenalin. The injection produces a bloodless field of operation, and mobilizes the mucous membrane.

(4) Other technical details of importance are the dissection of very wide flaps, and the complete mobilization of the bladder, which should be dissected off the cervix up to the loose peritoneum and then pushed out of sight with a swab. They must now be restored to their normal position by plication of the whole length of the urethra, and the visible portion of the bladder. At the conclusion of the operation, the urethra has been narrowed, the urethrovesical junction narrowed and supported, and the posterior urethrovesical angle restored.

Dr. J. L. Marcel (Paris)

Stress incontinence has become more frequent since the last war, possibly because of deficiency states in women during this tragic period and of diverse types of muscular weakness such as have been reported from many Continental countries.

I will confine my remarks to treatment. Thirty-six operative procedures are used, which may be classified under three headings: (*a*) urethroplasty; (*b*) musculoplasty; (*c*) the raising and supporting of the bladder neck.

The dozen procedures suggested for *urethroplasty* aim at creating a buttress of scar tissue round the bladder neck. The procedure is called Bonney's operation in England, Howard Taylor's operation in the United States, and the operation of Marion in France. This last author described the operation in 1912 and it was regarded as satisfactory in France until 1940. When it failed it was usually the operator or the patient who was blamed rather than the procedure. As a pupil of Marion, I used this operation for many years and obtained good results, but also a few failures. During the last 10 years the percentage of failures has increased and has

lately approached 50 per cent, probably because of the severity of the cases we are now seeing. The procedure, although it is not discredited, has lost much of its reputation.

If cystocele be present I have found it useful, from the point of view of prognosis, to insert a ring pessary. If this relieves the stress incontinence a vaginal repair of the cystocele is all that is required.

Musculoplasty. This aims at creating around the neck of the bladder a new contractile sphincter by utilizing a neighbouring muscle with preservation of its nerves and muscles. Goebel Stoeckel's operation utilizing the rectus abdominis was the most commonly employed, but it has now been largely abandoned.

The raising and supporting of the bladder neck. Of the many operations (at least 12) suggested for the support of the bladder neck most employ an aponeurotic sling. These operations are reliable but complicated and usually require a joint abdominal and vaginal approach.

I wish briefly to describe the operation of Delinotte. He utilizes a tendon from a dead-born calf to each end of which is fastened a stout silk thread. An incision is made into the anterior vaginal wall and a wide dissection of the bladder neck is made. A very small suprapubic incision is performed through which the calf tendon is inserted and passed round below the neck of the bladder. It is difficult to decide how much tension should be applied and Teinturier has suggested that the silk sutures should be left provisionally on two forceps and should be fastened after the patient is conscious and trying to push or cough. Delinotte's operation is simple but not free from risk. Postoperative suppuration may be troublesome but does not usually prevent a successful result. I utilized this operation in 10 severe cases and obtained 8 successes, of which 4 exhibited postoperative complications. In the 2 failures the patients were young and their incontinence was congenital. In a personal communication, Millin told me that the latter procedures which he has advocated owed much to the work of Delinotte.

In short, I believe stress incontinence to be a condition which is not grave except in young people, but is always troublesome. In some cases it is possible that muscular re-education by gymnastics and physiotherapy may render life acceptable, but in most cases surgical interference is necessary. No operation is consistently successful. In mild cases which do not respond to physiotherapy I remain faithful to the simple plication of the neck of the bladder and in more severe cases I use the sling operation as described by Delinotte.

I intend to try the operation of vesico-urethrolysis as advocated by Mulvany and recently praised by Gordon Lennon.

Mr. J. E. Stacey (Sheffield)

There are two men present today to whom we all pay tribute for their pioneer work and thought in the attack on the problem under discussion.

The first is that master of the English language, Sir Eardley Holland, who first saw the problem clearly when he used the term *stress* incontinence. Hitherto most of us had looked on the symptom which some women with prolapse suffered from as incontinence and must have wondered, as I did, when I came under the influence and teaching of Archibald Donald, William Fothergill, and other pioneer gynaecologists of the early part of this century, why only some and not all women with prolapse suffered from incontinence. It required the acute observation of Sir Eardley Holland to recognize that it was not incontinence from which these women suffered, but only incontinence when under stress.

The other man present to whom we pay tribute is, of course, Albert Aldridge, one of the early people to recognize the problem and, by his fascial sling operation, to attack it from a different angle. One of the factors which most impresses me in Aldridge's attack on the problem is his repeated, modest, but insistent claim that stress incontinence can usually be cured by a well-designed vaginal plastic repair operation.

The cure of stress incontinence is dependent in the first instance on an accurate assessment of the reason why women are physiologically continent, and in the second how they void urine.

The old view that a sphincter muscle always in action retains the urine in the bladder, while

its relaxation initiates the act of micturition, fails because neither anatomically nor histologically has any sphincter ever been demonstrated. The intravesical pressure is at most a few centimetres of H_2O, and gradually becomes less as the bladder fills to capacity. There is, therefore, no force to open the vesico-urethral orifice, which is kept closed by the physiological angle occasioned by the tone of the pelvic floor. The urethrovesical angle is preserved by a reflex increase in tone as the intra-abdominal pressure becomes raised by stress. When the woman voluntarily micturates she does so by relaxing the pelvic floor, thereby straightening out the urethrovesical angle described by Jeffcoate and Roberts. The funnel at the junction of the bladder and urethra is thus opened, with a consequent flow of urine which is voided by voluntary effort.

The loss of normal pelvic floor tone, such as is present in many cases of prolapse, allows a slight increase of the intra-abdominal pressure to cause a straightening out of the urethrovesical angle and, in consequence, stress incontinence. The cure then lies in an artificial elevation of the neck of the bladder which can usually be effected by a well-designed vaginal plastic repair, and above all by elongating rather than shortening the anterior vaginal wall.

In a few cases, but only a few, this cannot be effected except by a suprapubic procedure and of all the methods I have tried, the best results have been achieved by an operation based on Aldridge's principles.

MR. F. STABLER (Newcastle upon Tyne)

LET me say straight away that I accept and admire the work done by Dr. Roberts and Professor Jeffcoate in their commonsense explanation of why numerous different operations, by reproducing this posterior urethro-vesical angle, cure symptoms of stress incontinence. Why is it that so many different procedures can cure the symptom? I am sure the point is that in all of them one traumatizes the peri-urethral tissues, and that without that trauma one would not get very far. Having traumatized them one must then splint them in such a position that the angle is reproduced. As the trauma heals that angle is maintained. Mr. Mulvany and Professor Lennon talked about vesico-urethrolysis. They claim that during the course of the confinement a haematoma has formed there and produced adhesions which they divide. In the place of those adhesions they are producing others. I defy anyone to free the urethra without producing a haematoma. That haematoma suffices, provided the urethro-vesical angle is maintained by some means, splint how you will, splint with abdominal fascia, splint with fascia lata, splint with catgut stitches, it does not matter how, so long as you reproduce that angle, and maintain it with the trauma you have produced.

I feel that we may be in the same position as the orthopaedic surgeons once were over recurrent dislocation of the shoulder. They performed an operation whereby the long head of the biceps was divided and passed through a tunnel in the head of the humerus. It was very successful when they first did it, but then they became expert at it. They became so expert that they produced no trauma and the result was that they began to get recurrences. They thereupon devised a much more traumatic and damaging operation, dividing the subscapularis and banging rivets into the scapula, thus producing a nice old wad of fibrous tissue and so preventing recurrence of the dislocation. Now it is possible that people are going to attempt to devise some less and less traumatic procedure, so leaving the urethra without this nice adhesion of fibrous tissue which will produce the kink, and when they have succeeded in doing so these operations will fail.

MR. G. W. THEOBALD (Bradford)

I HAVE enjoyed listening to the papers this morning, and in particular to the erudite contribution by Dr. Aldridge. I accept the findings of Professor Jeffcoate and Dr. Roberts, but time alone will show whether their explanation is correct. So far as surgery is concerned, I perform vaginal hysterectomy in all women over 40 years of age and shorten the parametric tissue in all young women without amputating the cervix and without removing any mucous membrane, and find myself in entire agreement with those who claim

that well over 90 per cent of all cases of stress incontinence can be cured through the vagina.

For over 5 years I have been curing stress incontinence of urine by cauterization of the uterus, and the results have been equally successful in those cases in which the cervix appeared to be perfectly healthy, and also in those in which the cervix had been amputated, as in those in whom the cervix was obviously infected. Perhaps the results are too good to be believed unless they are seen.

Most of the cases Professor Jeffcoate described this morning which showed no obvious evidence of prolapse could, I believe, have been cured in the out-patient department. Further, of the 50 per cent of cases of marked uterine prolapse who suffer from stress incontinence, approximately half can be cured of this distressing symptom, for at least a time, by the same simple procedure. The prolapse will, of course, ultimately have to be surgically treated.

The brilliant work which Professor Jeffcoate and Dr. Roberts have reported this morning suggests that the normal urethrovesical angle is maintained by the action of involuntary muscle. In my view the results obtained by cauterization of the uterus (the main factor is probably the cauterization of the internal os) are due to the effects of this procedure on pelvic sympathetic nerves. One of the results of this treatment may be the restoration of tone and function to the involuntary muscles which maintain the urethrovesical angle. It may, therefore, be that Professor Jeffcoate and Dr. Roberts have provided the anatomical basis, and the results of cauterization of the uterus the physiological basis of both continence and stress incontinence in women.

I would, in conclusion, suggest that pure stress incontinence, incontinence with urge, incontinence with both frequency and urge are not entities, but that they are often, if not always (infection and disease of the bladder excluded) all part of a syndrome.

Dr. W. R. Sloan (Belfast)

When Shakespeare used the metaphor " as leaky as an unstanched wench " he had in mind that feminine complaint which we are discussing here today. When one has regard to the incidence of genital prolapse that still prevails one may well wonder if it is any less common in our time than in his. In the Samaritan Hospital, Belfast, more than one-third of our annual bed occupancy and of our operating time is devoted to this condition. If anything like this same state of affairs prevails in all the gynaecological units in the country then in terms of human discomfort and cost to the nation this is the biggest problem that faces us.

Of the 320 patients submitted to operation for prolapse in the past year, one-half had defective bladder control. Of 49 presenting with a history of previous repair procedure, 35 still had stress incontinence, and of 13 presenting for a third time, 10 were still incontinent. These figures illustrate the well-known fact that each successive plastic operation carries a diminishing prospect of curing stress incontinence. It is, of course, for these intractable cases that the fascial sling procedures have proved particularly useful. But their use can, I believe, be profitably extended to many cases where one plastic procedure has failed to cure the stress incontinence and also to a few in which it will be found expedient to use it as a primary procedure, combined with surgery for some other condition.

The series which I present consists of 31 cases operated on by the suprapubic route and followed up over periods of from 5 years to 6 months. Of these patients 2 had submitted to 3 vaginal procedures, 6 to 2, and 19 had had 1. Four had had no previous operation, and, of these, 3 were treated to a sling incidental to some other major procedure. The age range was from 33 to 68 years; parity varied between 0 and 11.

I commenced by carrying out a standard Read-Millin procedure, using a vaginal pack, Pfannenstiel incision, and 2 transversely cut slings. I have gradually moved away from that by stages, each change being determined by the accidents of experience. First, having the misfortune to tear off one sling and not being able to afford to cut a new one, I found that one does just as well. Then after some trouble with old paramedian scars, coupled with my growing belief that it is the resulting fibrosis rather than the supposed action of the abdominal musculature that cures, I adopted a midline subumbilical

incision. At the same time I began to cut the fascial strip vertically from the edge of the incision in the rectus sheath, leaving it attached at its lower end. I have found this easier, particularly in the obese case, and more than adequate as to length of sling. Up to date there is no difference in the end results.

Following an unhappy experience with a sling which had entered the vagina I now use a Fergusson's speculum instead of a vaginal pack. With one or more sanitary pads placed against it and the patient's thighs brought tightly together the resultant upward thrust gives a longer urethra and an easier approach from above. More important, one knows immediately if the sling-passing instrument enters the vagina and is thus able to withdraw and repass it in the proper plane. For passing the sling I have tried quite an assortment of instruments and have found those designed by Mr. McIntosh Marshall the most generally useful. On 2 occasions, however, I attributed the entry of the sling into the vagina to the fact that the urethra-holding instrument had pinched up a fold of the vaginal wall thus ensuring its penetration by the sling-carrier. I now merely use the holding instrument to define the urethra, and once the sling-passing instrument is placed properly below it I remove the holder and pass the carrier against my middle fingertip. I have recently modified the sling-carrier in a manner that allows better vision and adds thrust to torsion, thus giving more strength and better control in its use. I have also substituted an open for a closed eye so that the silk ligature can be fed to it in the manner of a Reverdin needle. As now carried out the procedure in a patient of average dimensions requires only half an hour.

In undertaking this operation there are two constant deterrents. The first and more easily dealt with is obesity frequently accompanied by hypertension. Twenty of these 31 patients were described as obese or grossly obese. I would advise the beginner at this operation to select for his first patient one of average dimensions or insist on preliminary weight reduction. The second deterrent is the low I.Q. of so many women with intractable stress incontinence. Nine of this series were eccentric or of less than average mentality. They appeared to be incapable of what Samuel Butler has described as "the considerable though in most cases unconscious labour of retaining that which it is a relief to be rid of". Such individuals are very unreliable witnesses, both before and after operation. The patient who brings only a grudging satisfaction with this operation is precisely the patient who does not do well with any operation, not because the procedure has failed, but because she is habit-ridden or clings to her condition since it adds to her self-importance.

In this series urethral or bladder-neck damage occurred 8 times, but of these 4 occurred in the first 8 operations. I now regard this as a minor incident, for in the presence of adequate drainage it causes little or no trouble. One ounce of methylene blue solution instilled into the bladder before commencing gives a valuable signal by its leakage and is also a warning not to withdraw the routine suprapubic stab drain quite so quickly as usual. A surprising thing is that despite the leakage of dye when passing the sling not all of these cases will subsequently drain urine through the stab drain. This, I take it, is due to the rent in the urethra being small and valvular.

Entry of the sling into the vagina is much more to be feared. This happened in 2 cases. In view of what some have written of this I ignored the accident and thereby learned a bitter lesson. The first case ran an uneventful course and was cured. In the second case the sling caused a pressure necrosis which resulted in a hemisectional fistula of the urethra. This required a very tedious repair followed by an application of the cautery. When I last saw the patient she had had no recurrence of incontinence and described herself as "wonderful", but I shall never again knowingly leave a sling exposed in the vagina.

Of the 4 cases in which a sling was combined with another procedure, the first was a subtotal hysterectomy for metropathia performed through a Pfannenstiel incision and followed by a Read-Millin double sling. I regret to say this patient died on the 5th day from massive pulmonary embolism. The others were all operated on through midline incisions and include a myomectomy and 2 total hysterectomies. One sustained urethral damage, but the postoperative

behaviour of this and the other 2 patients did not differ essentially from the usual. In combining the sling with total hysterectomy it will be found much easier to pass the sling first when the Fergusson speculum can be accommodated in the intact vagina.

After operation it is common for patients to complain of some "urge" for anything up to 6 months, though this symptom generally disappears before the third month. This, I believe, is due to a combination of habit, or harking back to their old estate, plus the presence of the sling and the healing process around the neck of the bladder. Urinary infection should be excluded and the patient given generous doses of reassurance with perhaps a little phenobarbitone.

Of the 30 surviving patients, in only one case have I been able to secure visual proof of recurrent "stress" despite a rigorous examination with a full bladder, and the patient standing on one leg. One other patient has written to say that she still suffers from her complaint and so must be counted as a failure. Of these 2 failures one has been subjected to the standard Read-Millin technique and one to my own vertical midline variation. The reason for the failure in one of these cases was simply wrong choice of patient—a querulous arteriosclerotic old lady of 68, who had had one repair many years before with an excellent anatomical result, but whose genito-urinary equipment was very atrophic at the time of my intervention. One other elderly lady of this type, on whom I finally operated after twice refusing to do so, was cured of her stress incontinence, but has had persistent residual urine and recurrent attacks of cystitis. One must entertain only limited expectations when advocating any sling procedure for such subjects. Two patients state that they cannot complete micturition satisfactorily without standing up and bending forward. This, too, appears to be due to persistent residual urine, for one of these was found to have 10 ounces of urine in her bladder 5 minutes after going to the toilet. Neither of them regards this as any hardship, and they are thankful to be dry.

Amongst the 28 cases regarded as cured to date are some of my most grateful patients. One of these illustrates well the value of a sling. She was 45 years of age and extremely fat, thanks largely to the sedentary life to which she was condemned. She had had 3 plastic procedures by different surgeons, but urine leaked from her so continuously that she was suspected, when referred to me, of having a vesico-vaginal fistula. She smelled so that she had to eat and sleep apart from her family and was housebound and miserable. After preliminary weight reduction of 2¼ stones, a Read-Millin sling was performed. She has now been dry and comfortable for 4 years, doing the heavy work of a farmer's wife and cycling into town.

Summary

Thirty-one cases of stress incontinence of urine treated by suburethral fascial sling operations are discussed. The operations performed were: Read-Millin (standard), 9; Read-Millin (1 sling only), 7; midline (using 1 vertical sling), 11; combined with other procedures, 4.

Results: 1 died on the 5th day from pulmonary embolism following a combined operation; 2 unqualified failures; 3 with persistent residual urine and some degree of dysfunction; 28 with no stress incontinence for from 6 months to 5 years.

MR. J. H. MULVANY (Epsom)

Vesico-urethrolysis for Stress Incontinence

THE only effective component of the bladder control mechanism consists of the internal involuntary sphincter. This muscle is adequate to close the bladder as may be judged, firstly, from the circumstance that section of the internal pubic nerves which supply the external voluntary sphincter does not lead to incontinence, although in some cases there may be some slight weakening of control; and, secondly, from the known inability of the external sphincter to control a urinary leak resulting from inefficiency of the internal sphincter. Hence, measures for relief of stress incontinence must be directed to improving the efficiency of the internal sphincter. The main function of the external sphincter, as well as its limitation, is expressed in the alternative name of compressor urethrae. It is not a true sphincter, being part of the deep

transversus perinei muscle; but by strong contraction it may possibly modify a stress incontinence to the extent of holding back within the upper urethra for a short period a few drops of urine which may have escaped into it.

With regard to suggestions that damage to the levator ani muscles plays a part in the development of stress incontinence, doubt may be expressed on anatomical and other grounds. These muscles, arising from the back of the pubes, lie about 1 to 1½ inches apart at their origins and pass backward to skirt the lateral vagina. They do not send a muscular expansion across the midline to act as a sphincter to the urethra, although a strong support is given by the fascial sheets which, passing across the urogenital hiatus, blend with the upper layer of the triangular ligament. Sections of the pelvis in this region may show striated muscle lying either in front of or behind the urethra and this has been named the levator urethrae or anterior sling; but this band of muscle is really part of the deep transverse perineal muscle and is neither a levator nor a sling. Its relationship to the urethra varies according to the level of section. If the cut is made just before the urethra passes through the triangular ligament, the muscle will be seen to lie in front of it; if a little more inferiorly, the muscle lies behind. Apart from this feature, it is quite clear that these muscles have nothing to do with bladder sphincteric mechanism, seeing that the levators may be cut away and their function completely destroyed (as in excision of the rectum) without in the least impairing or even disturbing urinary control.

It would seem, therefore, that routine manoeuvres utilizing the levator muscles for the purpose of curing stress incontinence do not take cognizance of the essential element of bladder control, which is the working efficiency of the internal sphincter. Further, from the standpoint of operative technique, the levators lie some 2 to 3 inches apart at the lateral vagina and can be approximated as a rule only with tension, even under deep anaesthesia, and certainly only at the expense of stretching and weakening the muscle elsewhere. With the return of muscular tone after recovery from anaesthesia and with the gradual dissolution of the sutures, there can be little doubt that these muscles revert progressively to their normal position, and it may be assumed that a cure for stress incontinence depending solely upon this measure would most probably be followed by early recurrence. As this anterior levator approximation, however, is usually followed by a routine repair, it is difficult to test the value of the manoeuvre.

Stress incontinence comprises two main groups. The first arises spontaneously from simple weakness of the sphincter and may be seen at three phases of life: namely in childhood from inherent or neuromuscular defect; in midlife from involutional hypotonia; and in senescence as a result of slow atrophy. All these three forms generally have no associated prolapse or urethrocele and hence derive great benefit from a vesico-urethrolysis as a result of the greater freedom given to the sphincter by division of the adhesions, albeit usually normal ones, which surround the bladder neck.

The second group of stress incontinence develops from damage to the triangular ligament during parturition, in association with a failure of the bladder sphincter to regain lost tone and power. It will be recollected that bladder control is greatly weakened by the process of stretching during labour, as is evident from the ease and frequency with which urine dribbles away in the third stage when the patient strains or when fundal pressure is applied.

The foetus has to pass through an opening in the triangular ligament which is normally only about 2 inches in diameter, and this can only be achieved by great stretching or, more likely, tearing of the ligament, usually in the midline posteriorly. This incident in itself does not lead to stress incontinence, the appearance of which depends on the extent of damage done to the anterior or subpubic portion of the ligament. Parturition in women having easily distensible levators, and/or an episiotomy, are naturally less likely to sustain damage to the important anterior segment and this probably explains why patients with severe perineal lacerations do not often develop stress incontinence. On the other hand, a difficult or long second stage (in which the contractions and

bearing-down stresses repeatedly force down the anterior part of this ligament supporting the bladder base and urethra) is certain to cause considerable trauma to the sphincter mechanism and is, therefore, very likely to be followed by urinary incontinence. During the puerperium all vaginal tissues, including the urogenital diaphragm, undergo involution and return to approximately pregestational proportions; but where stretching of the anterior segment of this membrane has been excessive, a permanent relaxation of the urethral and bladder support allows this area to drop. The superior aspect of the bladder neck, however, retains its normal attachment to the rear of the pubes, so that lack of support from below leads to widening of the sphincter area and loss of sphincteric power. This state of affairs is aggravated by abdominal strain.

Vesico-urethrolysis is a simple measure aimed at freeing the sphincter area in a good part of its circumference from the adhesions which tend to hold the sphincter muscle in a stretched and operationally ineffective position. In this way the muscle is enabled to retract—an inherent quality of all muscle and especially of sphincters—and its power of contraction is enhanced. In all forms of stress incontinence without urethrocele, and not otherwise due to neuromuscular or local deformity, this measure is most successful. The operation is very brief, taking about 2 minutes after exposure of the retropubic space.

The technique is very simple. After opening the retropubic space, a finger is swept round the bladder wall, freeing it, the bladder neck, and abdominal urethra, from all visible adhesions which secure the organ to the parietes. In the course of the operation, there are seen successively the iliac vessels, the obturator internus and obturator nerve, and lastly the white line leading on to the levator muscle. Anteriorly the fascia from this muscle passes to the midline, closely investing the urethra and bladder base and forming a tough supporting floor. This toughness and the liberal sprinkling of veins make the repair of a urethrocele easier to attempt from below. In the same area, the median and lateral pubovesical ligaments are seen and these may be cut or left intact, depending on whether a sufficient degree of vesical relaxation has been obtained. Posteriorly, the ureters usually come into view. The presence of a moderate degree of vault prolapse is not a contra-indication, as this condition may be remedied by subperitoneal suture of the utero-sacral folds. It is important when doing this to define the vaginal ends of these ligaments for at least 1 to 1½ inches. Their approximation by 2 or 3 mattress sutures will produce an appreciable tightening of the cardinal and pubo-cervical ligaments, as all these various folds, although anatomically distinct, form part of a single fan of supporting tissue.

Stress incontinence with urethrocele is best treated from below by a routine repair, special emphasis being given to freeing the triangular ligament from the vaginal wall as far laterally as the pubic rami and forwards to the transverse pelvic ligament. In other words, a sufficient degree of lysis of the sphincter area is also essential for success from below, and lack of thoroughness at this stage may be responsible for failure to restore sphincter power in what has otherwise been a technically perfect operation. In general, no special emphasis is given to this point in gynaecological works, and the significance of this step may escape notice. Having freed the triangular ligament as indicated, it simply remains to push up the relaxed membrane with attached sphincter area and to apply a suture to retain it in this elevated position. A mattress suture is passed through the vaginal wall on a level with the urethral orifice close to the pubic ramus, taking up in its course the adjacent parts of the bulbo-cavernosus muscle and triangular ligament on each side. When this suture is drawn together, these 3 structures are approximated, creating a firm support to the bladder base approaching normal anatomical proportions and ensuring relaxation of the sphincter muscle. Where evident weakness or attenuation of the triangular ligament is present, as may be assessed from the extent and thinness of the urethrocele or is suggested by an early recurrence after repair, or where such may be anticipated from the presence of a chronic cough, the Aldridge type of fascial repair should be carried out in the first instance.

Vesico-urethrolysis in properly indicated cases is followed by immediate relief although some degree of urgency or frequency may persist for a few weeks. Control is, however, uniformly good in all cases in which the sphincter muscle is intact. The benefit which so constantly attends a simple vesico-urethrolysis suggests that many vesico-urethropexy operations succeed more by virtue of the free mobilization of the sphincter which the application of these measures entails than in themselves.

In suitable cases the operation is one in which return to normality or benefit amounting practically to cure can be promised. Over 80 operations, some done as long ago as 4 years, have been performed. Complete failures have been seen in 2 cases with second-degree prolapse and urethrocele, in which the abdominal route was chosen partly on account of anticipated difficulty in a hysterectomy by the vaginal route, and partly to test the value of the operation in marked prolapse. One case referred on account of no relief following repair, but who showed nystagmus, intention tremor, and emotional instability, has had alternating periods of control and incontinence. One other case has retained such a degree of frequency, due presumably to trigonal irritation, that micturition is still as frequent as before the operation. Six other cases have difficulty in holding amounts of over 12 ounces, and thus experience discomfort in cold weather. In two of these it would seem that the bladder capacity is reduced. Previous to operation, however, incontinence had been constant. All other cases have retained satisfactory control.

PROFESSOR BRACHT (Berlin)

WHEN operation for stress incontinence by means of plication of the sphincter has not produced the desired effect, the next step is always difficult. None of the methods which can now be used can compare with simple plication. Most of them involve transfer of tissues between abdominal wall and vagina, with the consequent risk of infection and of necrosis of the transferred tissue.

In the operation I have devised, all contact between the vagina and the abdominal wound has been avoided. I formerly used a long needle for the Aldridge operation, fixing the end of the fascial strip with 3 stitches. The needle was then passed through the rectus, towards a finger placed in the vaginal wound alongside the bladder, thus avoiding the vagina-to-abdominal-wall approach.

More recently, however, I have used nylon in two different forms instead of body tissues. Two long nylon threads are fixed to the margin of the rectus muscle and its sheath, through an incision 6 cm. long over Poupart's ligament. Two other threads are fixed 2 cm. higher. All 4 threads are passed through the eye of a long light curved needle, 4 mm. in diameter. The point of the needle is guided through the rectus muscle behind the symphysis. The process is repeated through another incision on the other side. Both needles are left in this position and are covered with a sterile towel.

The two wounds may be closed now, to avoid touching the abdominal wall later, or they may be closed later after changing gloves.

The patient is now placed in the lithotomy position. The anterior vaginal wall is divided by a longitudinal incision, only a small strip of mucosa remaining attached to the bladder neck. The lumen of the urethra is infolded by 4 stitches, producing within it a crest.

The vaginal wall having been separated laterally from the bladder, a finger-tip is gently inserted into the wound behind the symphysis. The point of the needle can be felt and recognized by moving the other end, which remains covered by the sterile towel.

The needles are then withdrawn into the vagina, and the 4 pairs of threads are passed through the 4 corners of a cushion-like roll of nylon net with an ordinary needle, crossed over, and tied beneath it.

The only danger is that of pulling the threads too tight, as the material is more resistant than the tissues of the body.

The vaginal wall is closed by sutures which include the nylon roll. The urethra remains supported by the roll of nylon net which is attached by the nylon sutures to the abdominal musculature.

DR. ROLAND S. CRON (Milwaukee, Wisconsin)

A HIGH incidence of failure for the operative correction of urinary stress incontinence has often been reported. This has not been our experience, especially when the lesion producing this symptom has been associated with cystocele, urethrocystocele, and uterine prolapse. Our material for study consisted of 224 women varying in age from 28 to 75 years, with an average of 48 years. Cystocele or urethrocystocele was present in 197 or 88 per cent, and some degree of uterine prolapse was found in 104, or 46 per cent. All of these patients, with the exception of 11, had relaxation of their perineal supports varying from a simple rectocele to an extensive enterocele formation and/or prolapse of the vagina.

The operative attack utilized for the relief of this problem was based upon procedures described by Davies. The main points in the procedure were extensive and wide dissection of the urethra, bladder neck, and frequently of the bladder base to its uterine attachment. It is interesting to note that 153, or 70 per cent, of these 224 women, were also hysterectomized by the vaginal route and 18, or 7 per cent, by the abdominal route. Plastic procedures alone were deemed adequate for 35, or 16 per cent. Two of these plastics were combined with the Manchester operation. Previous unsuccessful attempts at correction of the incontinence had been made in 17 instances.

Unsatisfactory results were reported by 8, or 3 per cent of the patients, but in only 1 was the failure complete. Three of these patients subsequently received complete relief from their incontinence by means of the suprapubic approach, as described by Marshall and Marchetti. Only 2 patients of the 224 studies could not be traced for follow-up observation. Subsequent to operation patients were advised to exercise the pubococcygeus muscle. We have not used the perineometer, but are enthusiastic about the improvement following training of the muscles of the pelvic diaphragm.

It is essential, in comparing end results obtained by procedures designed to relieve symptoms, that authorities compare similar lesions. It is quite possible that the patients who have been relieved of urinary stress incontinence by physiotherapy alone did not demonstrate the defects we found in our group.

The splendid end results that have been obtained may be attributed to the following factors: (1) all operations were performed by 2 operators on private patients whose nutrition was most adequate; (2) extensive mobilization of the bladder and urethra was practised; and (3) a vaginal hysterectomy was also performed in 70 per cent of the cases Great care was exercised to increase the angle of the urethra. Satisfactory healing of the vagina was greatly enhanced by a marked reduction in morbidity following the routine use of a penicillin or terramycin pessary introduced into the vagina 12 to 16 hours before the operation.

Our experience with the Aldridge sling operation has been a very limited one, due to the fact that we rarely encounter patients necessitating this procedure.

DR. A. P. NETTER and ALICE E. LAMBERT (Paris)

WE should like to give a preliminary report on the use of methylandrostene-diol in the treatment of stress incontinence.

Androstene-diol differs very little from androsterone and dehydroisoandrosterone but this slight chemical difference is sufficient to make it lose almost entirely its androgenic properties. For this reason it has been discarded for therapeutic purposes.

Physiologists, however, have discovered that besides virilizing properties, androgens possess renotrophic and protein anabolic activity.

Methylandrostene-diol has been shown to restore the atrophied levator ani muscle in the castrated rat, when given in quite small doses. This action is not confined to the levator ani but extends to other muscles.

We decided to use this special property of M.A.D. in an attempt to relieve some cases of stress incontinence.

Seven patients were chosen, all of them severe cases. Two had been operated on twice without lasting effect; 4 others were women who did

not desire operation; the last case, a woman of 32, we treated pre-operatively. Five patients received sublingual doses of 100 mg. daily for 3 weeks, the course of treatment being repeated 3 times at 3-weekly intervals. Two patients had 100 mg. 3 times a week by intramuscular injection for 3 weeks. Three similar courses were given at 3-weekly intervals.

In 2 cases there was no result, functional or physical

In 3 cases functional results were fairly satisfactory. In 2 of them stress incontinence, which formerly occurred daily, appeared only once a month, between the 7th and 10th days of the cycle. In the third, it occurred at weekly instead of daily intervals. In 2 cases functional results were very satisfactory: stress incontinence disappeared.

The physical results were much less satisfactory. In only 1 case was there physical improvement of the uterine prolapse. The other 6 cases showed no difference at all.

It is not possible to administer the drug indefinitely and the treatment, we feel, should only be considered as an adjunct to surgical treatment, or where there has been recurrence in spite of repeated operation.

DR. GABRIEL (Sydney)

TO ALL those who have gone before me, thank you so much for helping me a lot. The information will be spread to some of my colleagues down under.

I would like to stress even the obvious. I have advocated that every lady admitted for surgical treatment for stress incontinence should have a cystoscopic examination done beforehand. It is not done everywhere in Australia, and I feel personally it should be done more. Hand in hand with that we should determine the difference between stress and urge incontinence, and that may, in some cases, together with cystoscopic examination, save the lady an operation.

I had the pleasure of going to a lecture in London. I went amidst the urologists purposely, and one Winsbury White was lecturing on gynaecological problems in urology, not round the other way. You know his work with the carbon die introduced into the cervix. He said straight out that many people, particularly those suffering from urge incontinence, could often be cured, not by operation, but by diathermy to the cervix. You thereby cured an infection in the cervix and that cleared up the true cause of the trouble which was a urethral trigonitis. I take the liberty of suggesting to Mr. Theobald that in his cauterization of the cervix he is clearing up an infection in the cervix, thereby curing the urethral trigonitis and saving the lady an operation.

The second point: I feel that in addition to a routine cystoscopic examination, thanks to Professor Jeffcoate, we should now include a routine cystogram investigation and, if we have the courage, repeat it after operation.

Thirdly, I still feel that there is a small—shall I say subsidiary—place for physiotherapy. The gynaecologist has a delightful little toy to loan to his patients, something in the nature of Kegel's perineometer, or vaginometer as we sometimes call it. Send her home and tell her to get the pressure up in 3 weeks . . . or else!

MR. CHALMERS (Worcester)

I AM grateful for this opportunity of describing to you my experience with the Marshall-Marchetti operation, about which we have heard quite a lot today, and particularly of telling you my reasons for preferring it.

During the past 3 years I have operated on 30 patients complaining of stress incontinence. All but one of these appear to have been cured. That one was a case of a condition which we have heard mentioned already today, namely congenital incontinence in a patient with a low intelligence quotient. In that case I failed lamentably, but in all the others the stress incontinence was cured.

The first 22 of these cases were operated on in Scotland and the series was investigated at the end of the first 2 years. At that time the earliest cases still remained cured, and I have a great hope that the long-term results will be good. I have tried to achieve a postal follow-up of the Scottish cases recently, but have only been able to get replies from 5, all of whom remain cured. The longest is now 3 years old and her

doctor tells me that the operation was successful and that she married again, which is perhaps an unusual result.

The operation, as shown by Professor Aldridge, consists essentially of suturing the vagina and the bladder neck to the back of the pubes and to the lower end of the rectus muscle. It was not clearly brought out, I think, in Professor Aldridge's pictures that the lower sutures are placed through the vaginal wall on either side of the urethra. We thus have a rather long sling, which compares with the other sling procedures in much the same way as a broad arm sling compares with a narrow arm sling. To my mind the great advantage of the operation lies in the fact that it does not demand separation of the urethra from the vagina when in many cases there may be a good deal of scarring from previous attempts at cure. In fact we have available a natural mechanism which can be used as a sling and which gives most excellent results. I consider that the sling operations are potentially dangerous, as Mr. Sloan has suggested. There may be difficulties in finding the right plane; the urethra may be damaged; and in fact, I have heard of a number of cases where the operation has been fatal.

I would not suggest for a moment that it is to be adopted as a primary procedure. Most cases of stress incontinence are associated with uterovaginal prolapse which can usually be dealt with best by a vaginal plastic procedure. There remain, however, the failures from this type of operation together with a number of cases of stress incontinence unassociated with prolapse. A useful pre-operative test is the Bonney procedure of pushing up the anterior fornix to see whether the stress incontinence is relieved. If it is I consider that the Marshall-Marchetti operation offers a good chance of cure. Marchetti in a recent letter told me that he finds that this primary selection is all-important and that if it is carefully carried out the operation can give very good results indeed.

I therefore consider it is the operation of choice in those cases where a vaginal plastic operation is either not indicated or has failed, and I consider it very much safer than the other retropubic operations which we have heard described.

PROFESSOR LENNON (Bristol)

I HAVE been very well brought up, seeing that I was brought up largely by Professor Moir at Oxford, where we saw the results of sling operations, results of cases sent us from outside. If you have ever seen some of the results where the slings have cut through the urethra, and where the woman has a cervicovaginal fistula, you would begin to think that there surely must be some simpler procedure.

When Mulvany published his paper last year it seemed that this was a much simpler procedure and I thought I would try it out. Now I can say from experience that I am convinced that it works. I can't explain as he did how it works, but it has worked for a short time, and I think we have got to wait for a number of years to see what the lasting results are.

I would like to confine my few remarks to one or two points. I am at the state now where I am undoing slings that have been inserted. Also, at Oxford we did provide ourselves with a certain amount of material from our own department, as some cases did have stress incontinence after our own operations, some from a series of 60 cases that I had done myself using Campbell's operation.

I now think it is a bad operation, but I have tried it and have reviewed these cases myself. Forty per cent had no stress incontinence either before or after the operation; 38 per cent had it before, but not after the operation; so that 78 per cent were all right. Twelve per cent suffered from stress incontinence both before and after the operation, while 10 per cent suffered from this condition after, but not before operation. This gives an incidence of 22 per cent of stress incontinence persisting after operation or recurring within 2 years of it. That did supply us with a certain amount of material for curing stress incontinence, which I mention particularly to stress the fact that, if we go carefully into our follow-up cases, the incidence of stress incontinence may be a little higher than we anticipated.

Now for the next slide. I have been doing cystograms, anteriorly, posteriorly, and laterally, before and after each one for some time now. I cannot project the lateral ones as Professor

Jeffcoate did. Here is a woman who had had an Aldridge sling operation without being cured. I think that picture illustrates the bladder at rest and without straining (you can see, I think, the other shadow underneath while she strained). I am convinced that this is the little indentation made by the sling. While working from below by the anterior vaginal wall approach, I dissected from either side of the urethra right through the triangular ligament and also pushed the bladder off the back of the symphysis. I thought I had failed in this case, because she appeared to be incontinent. She had, however, a very acute urinary infection and when it was successfully treated she was cured of her stress incontinence.

Now the interesting thing about that woman was the fact that she had said herself "I notice a difference when I am passing water, I can feel that I am passing it." The woman with stress incontinence very often finds herself wet without feeling the urine come through the urethra, but when you have cured the condition she will very often say that she now knows that she is passing urine from her bladder and can feel it, and I think perhaps—I do not know—that there may be a urethral sensation.

Some of the cases after being cured have had peculiar streams. I have not interfered with the urethra in any way, but I have simply mobilized it, but they do get peculiar streams and sometimes they have been known to wet their slippers while micturating, but this condition rights itself.

Well, I do not want to say any more except to emphasize Mr. Leonard Phillips's point that registrars and house men should not do difficult vaginal operations or slings without supervision, and then only after having assisted with many cases.

PROFESSOR J. C. MOIR (Oxford)

I SHOULD like to commence by saying that I think that the important papers read this morning will be quoted by teachers in this country for some time to come. One of my reasons for getting up is that my recent colleague, Professor Lennon, very kindly said that he was well brought up and then went on to tell some ghastly stories of holes in bladders and slings cut through—and so on. I am sure that I have his permission to say that he perhaps omitted to point out that the reason he saw so many of these cases was that I have an innocent and possibly incomprehensible interest in patching holes in bladders, and that those cases were really presents bestowed on me from elsewhere.

I agree with Mr. Phillips that if colporrhaphy is properly done the patient seldom returns, but a few do and that is where the sling operations come in. I personally have no experience of the Marshall-Marchetti operation, but about half the surgeons in this country perform the Aldridge and the other half—perhaps the bigger half—the Millin operation. If they are correctly done they are equally successful.

The Millin operation possesses the advantage of speed and a single approach, but also inherent potential dangers. Both the bladder and urethra may be perforated and the urethra may slough off owing to the pressure of the sling. Some of the very worst cases of fistula I have seen, and far the most difficult ones to cure, have followed a Millin operation. Another difficulty with this operation is that it is very difficult to judge the tension of the sling accurately and many of these patients have some residual urine for months afterwards.

I therefore have a strong preference for the Aldridge operation; in fact, Dr. Aldridge, I would like to say that I am one of your disciples and have many times sung your praises in this country. Although this operation takes about 20 minutes longer, you can see what you are doing, can judge the precise tension of the slings, and the operation is much safer and gives at least as good results.

The third point I want to make is that no decision as to the benefit which accrues from any operative procedure should be made for at least 6 months, and preferrably longer, after it has been performed. Further, the patient should be examined by the surgeon himself when her bladder is full and not empty. This point is all the more important seeing that we are confused by the successes claimed for so many apparently diametrically opposed procedures.

DR. A. W. PURDIE (London)

I HOPE you will pardon my raising one very simple point and that is the importance of the accurate diagnosis of stress incontinence of urine. In operating on these patients I have always been very careful when taking the history in cases of prolapse, not only to ask the patients if they had stress incontinence, but to make sure that it could be demonstrated.

It took me a long time to discover that stress incontinence cannot always be diagnosed with the patient in the lithotomy position, but could always be demonstrated if the patient were asked to stand, bend, and then cough or strain.

When it comes to the assessing of results, I would stress that the most severe test should be given before it is said that she is cured of stress incontinence.

DR. ALDRIDGE (*Reply*)

FROM reports presented today on treatment of stress incontinence and the splendid discussion which has followed it is obvious that all of us are attempting to solve this problem by procedures which incorporate similar principles. It seems certain now that stress incontinence is due essentially to abnormalities of structures in and about the vesical neck and proximal end of the urethra. We do not yet have complete knowledge of changes which permit leakage of urine to occur. As has been pointed out by Mr. Stacey, no one has ever seen a urethral sphincter or proved that there is such a structure.

Placement of a fascial sling to support the urethra requires a meticulous technique. It seems certain that accidents reported in carrying out such procedures can be avoided by preliminary mobilization of the urethra and bladder by the vaginal route.

Findings reported by Professor Jeffcoate and Dr. Roberts may prove to be an invaluable contribution to our knowledge of stress incontinence. Results of their studies confirm our conviction that stress incontinence is the result of changes in tissues in and about the vesical neck and proximal end of the urethra. Their findings could easily explain why some operative procedures fail and why others are successful. If a means could be found to restore normal angulation between the proximal end of the urethra and the vesical neck, it might be possible to abandon all the extensive suprapubic procedures which have been designed to support the urethra and bladder neck at a high level in the pelvis.

Ball of Cornell has reported excellent results by combining an extensive dissection to mobilize the urethra and bladder from the anterior vaginal wall, a plastic on the urethra, tightening of the vesical neck by the Furniss technique using mattress sutures on its anterior surface, and suspension of the urethra and bladder to the pubes and anterior abdominal wall. He does not know which of these steps contributes most to his favourable results but believes that tightening of the vesical neck can be most efficiently accomplished by sutures on its anterior surface.

Whenever an extensive, complicated operative procedure is recommended for relief of any surgical condition, we should suspect that it is not the answer to the problem. For the present, procedures recommended for stress incontinence must be used to achieve as good results as possible. However, there is already reason to hope that a simple operative procedure can be developed which can be depended upon to cure this troublesome condition.

PROFESSOR JEFFCOATE (*Reply*)

IT is quite clear from the discussion today that many methods of treating stress incontinence are being practised. It is also quite clear that not any one of us can practise all these methods and come to judge the results personally. It becomes all the more important to emphasize what many speakers have emphasized today, namely that reported results should state very clearly what type of case was treated, whether in fact it was true stress incontinence, and how the result was assessed and when. We are all aware, I think, that the longer one waits, the less satisfactory are the results of any form of treatment of stress incontinence. It is also necessary personally to interview and examine every patient before being sure whether the patient is cured or not,

and a message on a postcard is completely misleading.

One word in regard to anterior colporrhaphy, which we are all agreed is the primary attack. Let me emphasize again, what I said this morning, that when this operation is successful, as it is in a large number of cases, the best results are seen when the angle is restored. In a very large number of cases which most of us would pass as fairly successful the angle is not restored, and the reason the patient is reasonably continent is that we are supporting a second line of defence. Ordinarily the sphincters of the urethra do nothing except empty the urethra at the end of micturition and allow the patient to interrupt micturition if she wishes. These muscles around the urethra can, however, apparently supply the second line of defence, and what we usually do in an anterior colporrhaphy is to strengthen the second line of defence.

If the anatomical features described today are important then what muscles are responsible for the urethrovesical angle? It was suggested by one speaker that if the uterus and vagina fall down that undoes the angle. That is certainly not true. The bladder can fall right outside the introitus and still maintain the most perfect relationship with the urethra. It is true, as some other speakers suggested, that if the anterior colporrhaphy is made too tight, or if too much scar tissue is introduced, then that does tend to destroy the angle. What is ordinarily responsible for the angle? Well, I am a little hesitant about this question because we have not the complete proof, but I would say this, that all the evidence so far available goes to show that the angle is a function of the involuntary muscle around the internal meatus. If this proves true, it would explain the temporarily good results which follow so many lines of treatment. It would mean that any local trauma, any irritation of muscle, any irritation of the nerves to the bladder, could, by toning up the intrinsic musculature of the bladder and the internal meatus, restore the angle, at any rate for the time being. It may be that this is one of the causes of our difficulties in understanding the many aspects of this problem.

Finally, sir, may I say how much I appreciate the very kind things that have been said about this work reported today. I would, however, acknowledge that the first work of this kind on stress incontinence was done by our American friends, Norris and Kimbrough, in 1928. They, like Schubert and Thomsen, depended mostly on antero-posterior and oblique X-rays. Schubert, in 1929, did take lateral pictures, but then abandoned the procedure as it was so difficult. We should, however, pay our respects to Mikulicz Radecki who published pictures in Germany in 1931, similar to those shown today, both before and after operation. He did not reach the same conclusions as we have. He perhaps did not have enough material to realize that the angle is significant, but if his pictures are examined they will show exactly the same thing as ours do.

The findings described today have meant a lot of work, and I say that because I wish to emphasize that I have not done it. The work has been done by Dr. Roberts, the inspiration was given 7 years ago by Mr. Malpas, and I merely happen to be the spokesman of the team. Thank you very much, sir.

GENITAL TUBERCULOSIS IN THE FEMALE

OPENING PAPERS

1. MAGNUS HAINES, M.D.

Director of Pathology, Chelsea Hospital for Women, London

OUR present knowledge of genital tuberculosis in the female appears to date from the closing years of the last century, when laparotomy was being adopted for the cure of tuberculous peritonitis (Berkeley, 1903; Williams, 1894). In the succeeding years a considerable amount of surgical material has become available for study. An entirely new group of cases has been appearing in the last 15 or 20 years. It is considered that these cases have come to light as a result of a change in clinical approach. In 1939 Schockaert and Ferin drew attention to the fact that many new cases, particularly of latent tuberculosis, were being diagnosed because of the adoption of routine endometrial biopsy—or curettage. By this method these authors found 7 new cases of endometrial tuberculosis in 9 months compared with 5 in the previous 5 years. We have had similar experiences at Chelsea Hospital for Women. In the 10-year period 1942 to 1951, 34 patients were diagnosed as a result of curettage or endometrial biopsy. No such instances are recorded from 1932 to 1941. This difference may be explained as being due to (1) the more frequent histological examination of curettings now practised at the hospital and (2) to the increased number of specimens submitted through the Fertility and Endocrine Clinics.

The increasing numbers of new cases in recent years revealed by more careful histological examination has encouraged pathologists to supplement their studies with bacteriological methods. Whilst tuberculosis may be diagnosed histologically, proof of the diagnosis rests finally on bacteriological evidence—the isolation of the infecting bacterium—*Mycobacterium tuberculosis*. A further indication for bacteriological technique has resulted from the use of chemotherapy which requires isolation of the organism even if only for sensitivity assessments.

As direct results of two things, (1) the discovery of latent cases of female genital tuberculosis, and (2) the advent of therapy with antibiotics, it seems reasonable to hope for an increased knowledge of the natural history and a reassessment of the methods of treatment of this disease. The pathologist can be expected to take an important part in both.

INCIDENCE

Women of all ages are liable to a tuberculous genital infection (Puxedda, 1941). It is uncommon in the elderly and the very young. Published and present data show that the highest incidence occurs in middle life, viz. ages 21 to 40 years (see Table I).

At Chelsea Hospital for Women during the 20 years 1932 to 1951 a diagnosis of tuberculosis based on the examination of pathological material had been made in 87 patients; there were 18 patients in the first decennial period and 69 in the second. It is interesting to note that of these 69 there were 34—almost half—in which the diagnosis was made initially on the histology of the endometrium. The incidence of latent tuberculosis amongst patients attending the hospital in the Fertility Clinic may be judged from a series studied in 1947. Curettings were examined from 200 patients taken consecutively, and 8 showed tuberculosis (4 per cent). This figure is in general agreement with those reported from other clinics (Bamforth, 1950).

AETIOLOGY

Tuberculous infection reaches the genital tract from another focus in the body in nearly every

TABLE I

The number of cases in particular age groups (q.v.) expressed as a percentage of the total number of cases reported

Centre	Author	Age	No. of cases	Percentage of all cases
Edinburgh	Callam (1951)	16-35	50	74.6
London	Haines	21-40	71	81.5
Glasgow	Sutherland (1951)	up to 34	147	83.3
Sweden	Jedberg (1950)	21-40	149	80.1
Sweden	Liljedahl and Rydén (1950)	20-39	129	87.1

patient. Instances of *primary* genital tuberculosis are uncommon and in them the infection is usually inoculational. Such lesions therefore involve the vulva or the cervix. True primary infections are reviewed by Finlaison (1936), Jedberg (1950), Sutherland (1950), and further cases are mentioned by Benjamin and Charnock (1949) and by Cameron (1951).

To demonstrate that the genital infection is a secondary one is not always easy and many published records have ignored the possibility. A previous or even a concomitant extragenital tuberculous lesion requires for its detection special interrogation of the patient, scrutiny of previous clinical records, and a complete clinical examination, as is shown by the reports of Winkler and Wegemer (1939), Dietel (1943), and Hagen (1947), who in their series of genital tuberculosis found earlier tuberculous extragenital lesions in from 38 to 44 per cent of cases. In a large and carefully investigated series of 186 patients Jedberg (1950) has reported earlier tuberculous manifestations in 105 (56.5 per cent). Chest lesions are the most frequent and his series includes 8 patients with erythema nodosum and only 1 with mesenteric lymphadenitis. Liljedahl and Rydén (1950) found X-ray changes in the lungs in 73 out of 113 patients. Russell *et al.* (1951), working in this country, have demonstrated that in several of their patients tuberculosis involved other systems as well as the pelvic organs. Patients seen at Chelsea Hospital for Women have had earlier tuberculous manifestations including pleurisy, cervical adenitis, iritis, peritonitis, pulmonary, renal, and bone infections. These preceded the genital infection by varying periods which in 2 of the cases were 39 and 21 years. Jedberg has pointed out that the association of renal with genital tuberculosis does not occur as frequently in women as it does in men. There are 2 patients in our series who had a tuberculous kidney removed 2 and 10 years before a pelvic clearance for genital tuberculosis.

Cameron (1951) has drawn attention to the apparent infrequency of genital lesions amongst sanatorium patients. He knew of only 8 patients who had genital lesions out of a total of approximately 1,000 women of child-bearing age whom he had discharged from a sanatorium, but he does not state whether any of these patients were found to have genital lesions in later years. On the other hand Jedberg (1950) examined 100 women in a sanatorium and found latent genital tuberculosis in 5 of them. These findings were not confirmed by Berry (1940) or by Schut and Teenstra (1951). Post-mortem studies, however, show that in women dying from pulmonary tuberculosis the genital system is often involved. Comyns Berkeley (1903) found unsuspected genital tuberculosis in 62 (7.7 per cent) of 798 women. Comparable figures are given by Perla and Biller (1939) and Berblinger (1946), who record an incidence of 8 per cent in 1,116 and 7.84 per cent in 328 cases respectively.

It is readily admitted that even in patients under careful supervision the hitherto latent tuberculosis of the endometrium may produce symptoms of genital spread. But other organs also may become involved—sometimes with fatal results. Such further spread, which is not always attributable to operative or other

treatment, supports the thesis of bloodstream dissemination. Some of our earlier cases are untraced but it is known that 1 patient has developed Addison's disease. The complication most frequently reported has been miliary tuberculosis (O'Brien and Lawlor, 1947; Jedberg, 1950; Russell *et al.*, 1951; Cameron, 1951; Callam, 1951). Sutherland (1943) has reported one case each of spinal and pulmonary tuberculosis and Jedberg (1950) one instance of renal involvement.

Such evidence of the occurrence of extragenital manifestations before, during and after the appearance of genital tuberculosis points to the conclusion that this infection spreads by the blood and that in many, if not all, instances the infection reaches the genital system by this route. An alternative route of infection is from the peritoneum either by lymphatics or through the tubal lumen.

It is well recognized that tuberculous peritonitis may precede genital tuberculosis often by many years and in a smaller number of instances peritonitis accompanies the genital lesion. In this second group particularly it is impossible to disprove the possibility of spread from the peritoneum even though it is not unlikely that the peritoneum has been infected from the tube. It is, however, arguable that peritonitis may be part of a primary or childhood infection and therefore most often of a bovine type. As the subsequent genital involvement is nearly always an adult form of tuberculosis and thus more likely to be a human type infection this is not an instance of spread but is a fresh infection from another source. Spread to the uterus and tubes from a focus in the mesenteric lymph nodes has also been suggested. This possibility is almost incapable of proof and the considerations of childhood and adult forms of infection applied above to peritonitis apply equally to abdominal lymph node tuberculosis. It is further stated that it is unusual to find enlarged mesenteric lymph nodes during laparotomy for genital tuberculosis. Jedberg (1950) found that amongst 31 married women with mesenteric tuberculous lymphadenitis 27 (87 per cent) had borne children, and that genital tuberculosis could not be found in any of the group which numbered 40. He also found that fertility was statistically greater in women diagnosed as having tuberculous peritonitis than amongst those with genital tuberculosis. These studies support the contention that peritoneal and lymph node tuberculosis play only a small part in the aetiology of genital lesions.

Morbid Anatomy

It is convenient to consider the morbid anatomy of tuberculosis affecting the internal genitalia first of all from the operating surgeon's point of view, i.e., as he sees it when he opens the abdomen. I shall exclude from discussion cases with general peritonitis and those with involvement of other viscera. There is one form of peritoneal tuberculosis which deserves special mention. It is characterized by greyish-white nodules or healed tubercles lying along lines of lymphatics and must be distinguished from carcinomatosis of the peritoneum. The diagnosis of genital tuberculosis before operation, i.e., on purely clinical grounds, is possible in less than half the cases. In some cases the uterus, tubes, and ovaries may appear normal to the naked eye or at most suggest non-specific inflammation. The diagnosis is made on microscopical examination. Whitridge Williams (1894) applied to these cases the term "unsuspected genital tuberculosis"—a term which was to have a fresh significance some 40 years later.

When gross changes are obvious on opening the abdomen, an inflammatory exudate is frequently present. The exudate, often copious in amount, is in the form of a coagulum. It is soft at first but by organization it shrinks and becomes toughened in the course of time. Such exudate may fill the pelvis completely, leaving only the fundus to protrude above its general level. The process of organization results in complete or partial resolution of the exudate. The resulting adhesions often make operative removal a difficult task. Alternatively, the quantity of exudate may be slight and no adhesions may be formed. The surface of those organs not covered by exudate usually shows intense vascular engorgement associated with small greyish-white tubercles.

Fallopian tubes

In a high proportion of instances (90 per cent or more) in which the uterus, tubes and ovaries are available for inspection it will be found that the tubes are tuberculous. Rich (1951) has drawn attention to the habit of the tubercle bacillus by which it attacks each one of bilateral organs, usually in succession, and cites the tubes as examples. This point is important in cases where tuberculosis of one tube is diagnosed and the other *looks* normal.

Berkeley, writing in 1903, commented upon at least two types of tubal tuberculosis and today we are familiar with the same two types. In one, to be called " the exudative type ", there is considerable swelling of the tube. This type of case was described by Haultain (1939) as a " huge pyosalpinx " in his paper on the treatment of pyosalpinx which he read before the 11th British Congress. Such " pus-tubes " have smooth or roughened surfaces, often with tubercles, but there is a remarkable scarceness or even absence of adhesions (Fig. 1). There may be a few adhesions between the tube and its ovary, but from the surgeon's point of view the tubes are mobile. Such tubes are filled with yellowish caseous material, often with a semi-purulent consistence. In the second type of tubal involvement—to be called " the adhesive type "—the tubes and ovaries are usually obscured by numerous and dense adhesions (Fig. 2). The tubes show only slight swelling and often not enough to be noticeable except on careful inspection. The fimbrial processes at the abdominal ostia may be swollen and the ostium may or may not be open. If the ostium be open the lumen may be blocked elsewhere, e.g., in the pars isthmica. In this type the inflammatory process involves the wall of the tube in a diffuse manner, while in the more chronic and commoner cases the involvement is patchy. Thus one or more swellings occur along the tube. The nodules which vary in size up to about 2 cm. in diameter are composed of caseous material, often showing calcification. The tubal contents are sometimes haemorrhagic and it is well to remember that a haematosalpinx can be tuberculous.

Tuberculous pyosalpinx has been mentioned above. Amongst the more chronic cases of both types, where resolution has taken place, hydrosalpinx may be found.

Ovary

The ovary is usually obscured from view by adhesions and when removed often escapes a pathological examination. It is stated that in those instances where uterus and appendages have been removed together ovarian involvement is found in approximately one-quarter of the cases. Following a previous operation when one ovary was conserved it happens not infrequently that the surgeon has subsequently to remove the remaining ovary because of pain or other symptoms. It is not unusual to find this second ovary involved—often possessing a caseous centre. One such case is mentioned by Haultain (1939) and there are doubtless many other like cases. Extensive tuberculous involvement of the ovary (Fig. 3) is not the rule. The infection is more in the nature of surface granulations (Fig. 4) which may extend with caseation into a follicle or corpus luteum. Infection by lymphatics or blood-stream may occur.

Uterus

It has been stated above that the organs may be normal in appearance. This is as true for the uterus as for the tubes and ovaries although in nearly every case the peritoneum covering the uterus shows engorgement of blood-vessels. The uterus may be normal in external appearance in instances with gross endometrial (and myometrial) caseation. A symmetrical enlargement due to pyometra is sometimes seen. The *myometrium* is in most instances involved secondarily from the endometrium. It may show slight to moderate enlargement. Caseous areas, a few or several, occur amongst the muscle bundles. The disease spreads outwards from the cavity and it is only rarely that caseous areas spread throughout the thickness of the uterine wall. Such areas may either rupture into the peritoneum or, more usually, they are covered over by dense adhesions which may include omentum and bowel. The *endometrium* may appear quite normal. Small, yellowish, shallow ulcers have been described, particularly near the cornu and often in continuity with similar changes in the tube. In the more advanced cases which are sometimes

FIG. 1
Uterus, tubes, and ovaries. Bilateral pyosalpinx—the "exudative" type of tuberculous infection.

FIG. 2
Uterus, tubes, and ovaries. Bilateral salpingitis—the "adhesive" type of tuberculous infection

M.H.

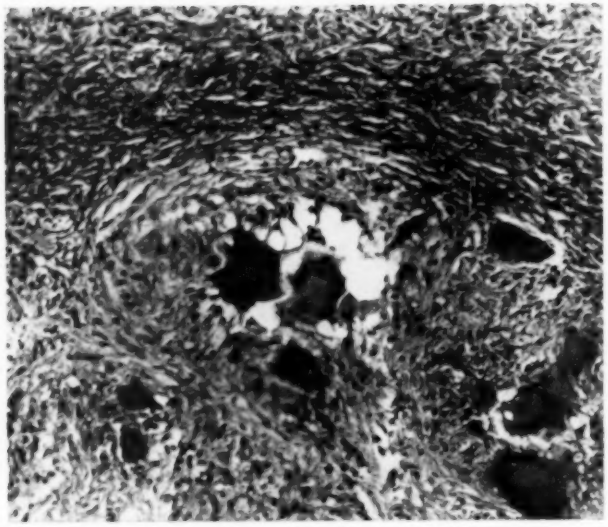


FIG. 3

Ovary. Considerable areas of tuberculosis.
H. & E. ×120

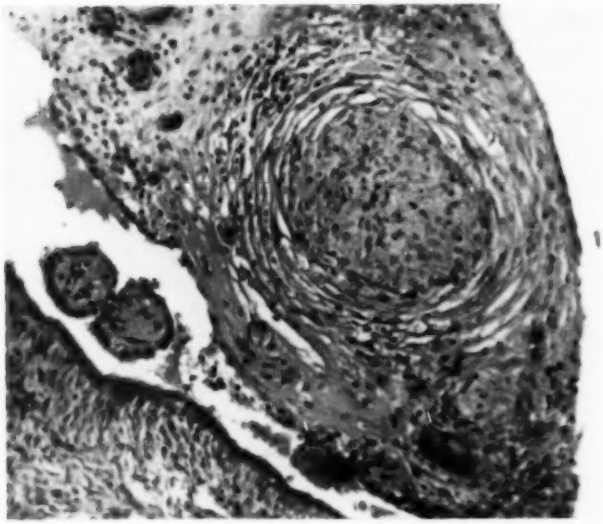


FIG. 4

Ovary. Surface involvement. A tubercule on the germinal epithelium.
H. & E. ×160

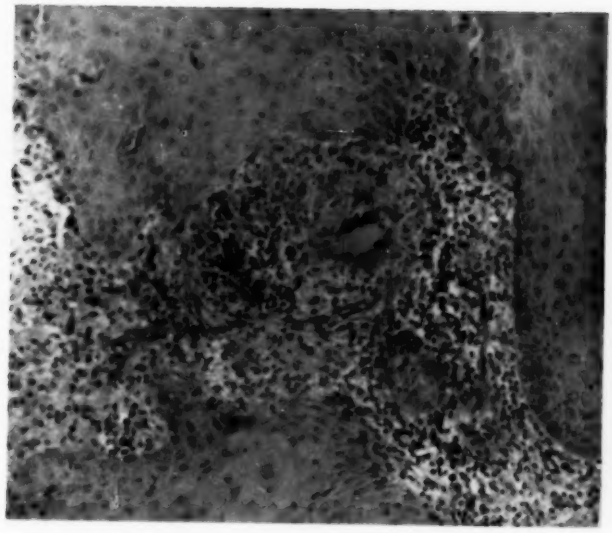


FIG. 5
Vulva. The superficial dermis showing a tuberculous focus.
H. & E. ×120

Figs. 5 and 6 are from the same patient, previously reported in this Journal 1936, **43**, 473.

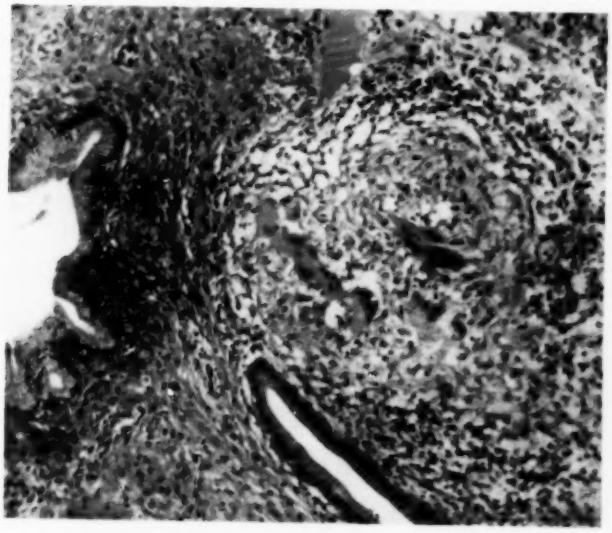


FIG. 6
Cervix. A tubercle close to an endocervical gland.
H. & E. ×120

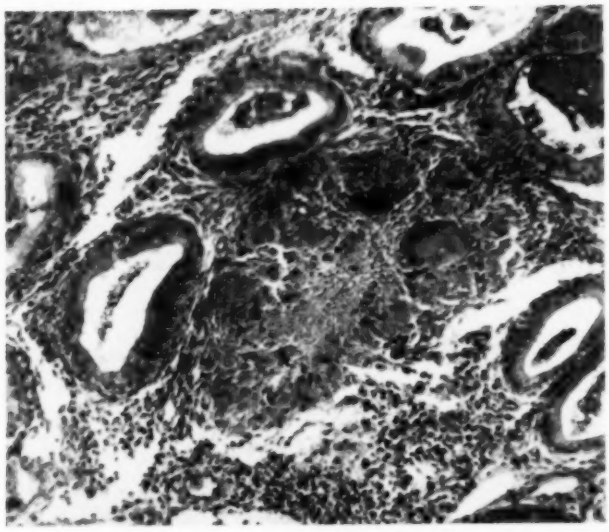


FIG. 7

Endometrium. Curettings showing a mature tubercle.
H. & E. ×120

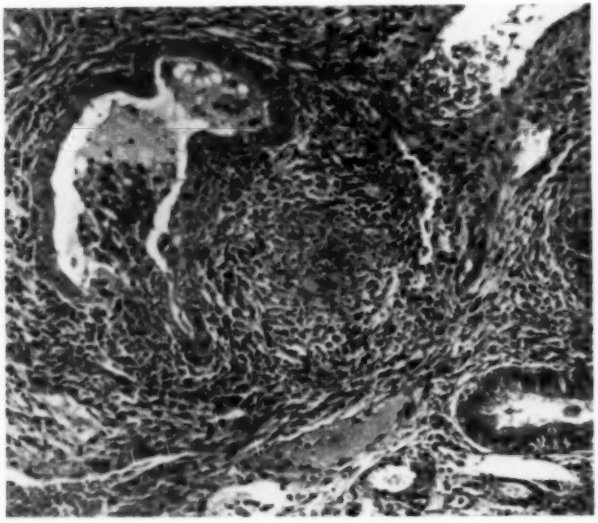


FIG. 8

Endometrium. An early phase in a developing tubercle.
H. & E. ×120

seen the normal endometrial lining may be represented by a yellowish membrane which may be smooth, ulcerated, or even warty in appearance.

If the whole uterus be extensively involved by tuberculosis, the appearance may be mistaken for carcinoma. This occurs particularly in a case in which a suspicious history of postmenopausal bleeding is present. In our series of endometrial tuberculosis a history of menopausal or postmenopausal bleedings has been present in 6 patients. Callam (1951) and Sutherland and Garrey (1951) record a further 6 patients with similar findings. Adenomyosis of the uterus complicated by tuberculosis has been reported on several occasions (Bland-Sutton, 1935; Johnstone, 1924; Stewart and Oldfield, 1932; Vaux, 1932; Stewart, 1933; Soldenhoff, 1948). This combination may also simulate carcinoma of the body of the uterus.

A description of the morbid anatomy of genital tuberculosis would be incomplete without mention of lesions in the external genital organs. By this I mean those lesions involving vulva, vagina, and cervix which may be seen readily, without an operation. They differ in naked-eye appearance from internal lesions because of a different (external) anatomical location. Thus in place of caseation, tubercles, and adhesions, there are instead ulcers, discharges, and scarring. The ulcers, often multiple, which appear on the vulva are shallow with greyish-blue irregular edges. They may be associated with sinuses and are nearly always followed by deep scars. Occasionally, exuberant granulation tissue is formed, producing a warty mass. Enlarged and caseous regional lymph nodes are characteristic but not always present. Tuberculosis may produce a granulomatous mass or ulcer in or near the glands of Bartholin but it is a rare condition (Schaefer, 1940). Vaginal lesions almost always occur in company with involvement of the vulva or cervix. The appearance is one of granulations or of irregular ulcers, associated with narrowing of the canal. The cervix may be involved by tuberculosis as an extension from above (the endometrium) or apparently directly by the blood-stream. The ectocervix, when viewed with the aid of a speculum, may show a variety of tuberculous forms. These have been described in full by Finlaison (1936). In the main the ectocervix is either ulcerated and craggy or shows a cauliflower-like mass of granulation tissue. In any case these changes readily extend to the fornices or along the endocervix or in both directions.

Histology

Recent experimental studies (Florey, 1952) have confirmed the conceptions previously held that tubercle bacilli are transported through the tissues within phagocytic cells. These cells, present in caseous material, are surrounded by necrotic and densely cellular tissue. These histological features as seen microscopically follow a fairly uniform pattern regardless of the organ or tissue which is infected.

The tuberculous reaction in the tissues comprises one or more focal lesions. Such lesions when large and numerous may coalesce to form extensive areas of tissue destruction. The lesions begin around a collection of infected phagocytes which become held up either in subepithelial lymphatics—as in the vulva (Fig. 5), cervix (Fig. 6), or tube—or, as in the case of the endometrium in lymphatics of the stroma, perhaps associated with lymphoid aggregates normally found there. There follows a rapid proliferation of reticulo-endothelial or endothelioid cells. Giant cells may be formed from them, but more constantly they and other tissues undergo a type of necrosis known as caseation (Figs. 7 and 8). Each focus is surrounded by a leucocytic zone and by connective tissue which tends to become avascular and fibrous. In most tuberculous foci the tendency to healing by fibrosis is nearly always strong. Florey (1952) has recently remarked in discussing chemotherapy that without this tendency "one might well despair of being able to do much with chronic tuberculosis in man".

Syphilis sometimes produces a tissue granuloma not unlike tuberculosis. Such lesions are infrequent internally but may be encountered in the cervix or vulva. Actinomycosis produces a granuloma in which the central parts are more purulent than in tuberculosis. The demonstration of streptothrix by Gram's stain will confirm the diagnosis. The lesions of lymphopathia

venereum and of granuloma inguinale must be considered where these diseases are endemic. Comparable histological changes may be seen in a variety of granulomas and ulcers due to trauma and foreign bodies. (Haines, 1951 a, b).

From the histologist's point of view each of these agents might show "giant cell systems" or "giant cells". It is, therefore, always necessary to bear in mind that tuberculosis has its own specific tissue reactions and is only one of many conditions in which giant cells may appear. Confusion in histological interpretation may also arise when lymphocytes are seen in the endometrium and other tissues. The problem has been investigated by Russell *et al.* (1951) and by Jackson (1951), but their findings are inconclusive. It should be remembered, however, that according to other authors (Teacher, 1935; Hertig, 1947; Dumoulin and Hughesdon, 1951; Haines, 1951b) scattered lymphocytes in small numbers or in focal aggregates occur naturally in the endometrium. They are part of the normal structure of the lymphatic system.

The dangers and shortcomings in the diagnosis of tuberculosis by histology have been fully illustrated in a paper from the Mayo Clinic by McDonald and Weed (1951) who state that "it is well recognized that many other agents may at times give rise to histopathologic reactions which simulate those found in tuberculosis" and that when possible it is desirable to isolate the causative agent in order that the patient may have the benefit of the proper type of treatment. This has been emphasized previously by Sutherland (1950). Rich (1952) and most investigators are agreed that the diagnosis of tuberculosis can be confirmed only by finding the tubercle bacillus.

Bacteriology

The methods commonly available for bacteriological examination are (1) cultivation on suitable artificial media, and (2) animal inoculation. Both methods are applicable to secretions and discharges and actual tissues, e.g. endometrium.

At Chelsea Hospital for Women all cases, when possible, are studied by guinea-pig inoculation and we have tended to reserve the first method for selected cases. The organism is subsequently recovered by cultivation from the guinea-pig lesions. Results by this method take longer to come through but possess a high degree of reliability. A small portion of suspected tissue is implanted amongst the thigh muscles of the guinea-pig and the wound is closed with a couple of sutures. I have described the details of this method elsewhere (Haines, 1951b) and also referred to other methods. Details of cultivation methods will be found in papers by Russell *et al.* (1951), Jedberg (1950), Halbrecht (1951), and in standard books on bacteriology. The material submitted for all types of bacteriological examination should be sent to the pathologist in a dry bottle. Tissues should not be placed in formalin or even in saline.

It should be emphasized that no one method can be expected to be 100 per cent reliable when performed on one occasion only.

The diagnosis is established by the isolation of the organism and cultures of it may then be used for (1) sensitivity tests with antibiotics, streptomycin, etc., and (2) for typing of strain, i.e., human or bovine. Antibiotic resistance is not unknown in the treatment of tuberculosis and the knowledge of its presence or development in a given case will naturally have an important effect on the course of treatment. Until the publication of Jedberg's (1950) large series no serious attempt seems to have been made to study the incidence of human and bovine strains in female genital tuberculosis. In this country most published data have been classified to show genital cases under one heading "genito-urinary system." But I suspect that the reason for the absence of specific data is that strains isolated from the genital system have not been typed except occasionally. However, the result of this grouping has in part been responsible for the idea, present in the minds of many, that female genital tuberculosis is often caused by the bovine bacillus. This impression might be reinforced by reading in a Report (1949) to the Medical Research Council on the incidence of non-pulmonary tuberculosis in England that in the age group 15 years and over the proportion of bovine infections in females was almost double that in

males. The females numbered 442 but the group "genito-urinary" contained only one with a gynaecological lesion. I was kindly permitted to scrutinize the individual case sheets used in the survey and it seems evident that the inquiry was not specifically intended to include female genital cases.

Jedberg's series of 178 cases showed a preponderance of human (93 per cent) over bovine strains. Our results on a much smaller scale show a 100 per cent incidence of the human type—16 cases. It seems evident therefore that as a result of further studies on typing it may be established that female genital tuberculosis is nearly always due to a human type bacillus.

In conclusion I propose to give the results of some of our investigations with special regard to diagnosis and the control of treatment.

The pathologist is often asked "When is the best time to take an endometrial biopsy?" Delarue and Bergerot-Blondel (1949) have suggested that fresh tubercles are formed during the growth of endometrium at each cycle. Consequently examination in the premenstrual phase should give the best chance of finding tubercles large enough and in sufficient numbers to be recognizable in curettings or even in a biopsy. I am in agreement with others (Sutherland, 1950) that curettings (or biopsies) for the diagnosis of tuberculosis of the endometrium should be taken during the week preceding the expected onset of menstruation. Such procedures should not be repeated except at intervals of 3 months or longer (Haines, 1951b).

As a laboratory investigator I am certainly in favour of curetting as opposed to biopsy of the endometrium because more material is thereby obtained. It is granted that from both patient's and surgeon's point of view biopsy is simpler, but I am always more ready to report on a negative curetting than a negative biopsy. It has been stated that it is harmful to the patient to perform or repeat these operations but experience suggests that the risk is negligible. It is increased when excessive or careless dilatation of the cervix is performed and it is greater still if this is followed by intra-uterine injections (Faulds, 1951; Sutherland, 1952). There is another risk—that of repeating the examination at too frequent intervals. A negative result may then raise false hopes of cure (Haines, 1950), because absence of signs of tuberculous endometritis in any given biopsy is not proof that the disease is not present (Sharman, 1952).

Our figures are too small for statistical analysis but I submit that they may be taken to show:

(1) that animal inoculation (as described above) is an efficient and reliable diagnostic test—agreement in 24 positive instances;

(2) that the animal test can demonstrate an infection
   (*a*) with doubtful histology—3 instances
   (*b*) with negative histology—4 instances
   (this factor is paramount in the management of patients receiving chemotherapy);

(3) that a negative animal test should be repeated if the histology is positive or doubtful;

(4) that the animal test allows isolation of the bacterium which is proof of the diagnosis. Histology, at most, can only presume it.

Animal inoculation has been invaluable in checking the progress of patients. The method has obvious disadvantages: it requires biopsy or curettage and facilities for animal work. Cultivation from menstrual discharges seems a reasonable alternative, but the procedure (Halbrecht, 1951) appears to give poor results. I have no personal data, but question the reliability of direct inoculation of culture media with endometrium. It might be used where suitable animals were not available.

Finally there is a question to which many gynaecologists wish to know the answer and it is this: "What is the likelihood of the tubes being infected if tuberculosis is present in the endometrium?" The question loses some of its interest when we remember that many patients with endometrial tuberculosis will heal naturally or are otherwise lost to the inquiry. But with an experience of slightly more than 20 patients with complete data we can endorse

Novak's (1947) statement that in every case of this sort on which he operated later there was unquestionable evidence of tuberculosis in the tubes.

It is a pleasure to thank members of the clinical staff of Chelsea Hospital for Women for their help in obtaining material and for permission to use the case histories; Dr. R. L. Vollum and Col. Bensted for the typing of cultures; Dr. H. P. Ferreira for his help with the animal work; and Dr. G. S. Wilson for arranging access to case sheets.

Invaluable technical assistance in various forms has been given by Messrs. J. W. Law, H. J. Turner, and A. F. J. Bailey.

I have drawn freely on the references given by Drs. H. Jedberg and A. M. Sutherland.

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2. JOHN STALLWORTHY, M.A., F.R.C.S., F.R.C.O.G.
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FOLLOWING Dr. Haines's excellent review I propose to deal entirely with the clinical features of genital tuberculosis. In 1938 tuberculosis endometritis was reported by Dr. Robb-Smith in curettings from Oxford patients with no signs nor symptoms of disease other than irregular bleeding. Interested, I wrote for information to several senior colleagues and discussed with others the possible significance of these findings. None was familiar with this condition of "silent tuberculous endometritis", but papers were soon published by Schockaert and Ferin (1939), and later by Rabau, Halbrecht, and Casper (1943), and Sutherland (1943).

With the limited material available since then our departmental research has been restricted deliberately in the hope of establishing guiding principles for safe clinical practice. Little attention has been given to certain aspects of the subject, for example the therapeutic effect of radiation. Plans exist for studying this in view of encouraging results reported (Ford, 1927; Polak, 1929; Campbell, 1947) and the improved facilities now available for radiotherapy. I trust these obvious defects in an opening address will be remedied by those present with experience to share.

MATERIAL

The series now presented consists of 78 proven cases; diagnosed, investigated, treated, and followed up in the Oxford Area Department of Obstetrics and Gynaecology. For these I have had personal responsibility. It does not include a considerable number referred by colleagues who have supervised the treatment advised, although the experience gained from these has undoubtedly influenced our attitude to the problems concerned.

The opinions presented today are based on a critical appraisal of the evidence to date. In spite of accumulated data the time is premature for dogmatic claims regarding treatment and prognosis, and a further review will be required within the next 10 years before the value of ideas at present held can be assessed fairly.

CLINICAL FEATURES

Any portion of the genital tract may be involved, from the vulva to the tubes. As the discharge from an infected uterus may contain the mycobacterium (Halbrecht, 1947; Jedberg, 1950; Clemetsen, 1947) and even cervical mucus may be infected (Thomsen, 1944; Jedberg, 1950), it is surprising that lesions of the vulva, vagina, and cervix are rare. There were none in this series, and only 7 in 369 cases reported by Sutherland and Garrey (1951). It should be noted, however, that not only can infection arise in this way, but that it may be transmitted during intercourse (Hellerstrom, 1939; Strand, 1945; Clemetsen, 1947). In Clemetsen's case, the husband of a woman with endometritis developed tuberculous ulceration of the penis. Asplund and Rydén (1952) claim that endocervical infection was present in 11 of 19 cases of endometritis. This incidence, if confirmed, would be important in relation to treatment to be discussed later.

The common sites of infection are the tubes and endometrium and the clinical manifestations are summarized as follows:

(1) None.
(2) Infertility.
(3) Menstrual disorders.
(4) Pain.
(5) Peritonitis.
(6) Fistulae.
(7) Postmenopausal bleeding.

(1) *None.* There are probably more women in apparent good health with unsuspected tuberculous pelvic disease than there are with symptoms or signs resulting in its detection. Some writers have asked why the symptomless cases, when detected accidentally, should be subjected to treatment and particularly to surgery. Russell, Jackson, and Midgley (1951) recently supported this *laissez-faire* attitude which the available evidence does not justify. The only fatal case in the Oxford series was a woman of 38 complaining of infertility. Endometritis was proven with no evidence of disease elsewhere. She refused treatment and died a

year later of miliary tuberculosis. Holtz (1940) reported 14 similar cases, and Jedberg (1950) a further 2. Eight other untreated Oxford patients developed adnexal masses while under observation and were cured surgically. *Genital tuberculosis, whether suspected or not, is a serious disease.*

(2) *Infertility.* Now that the biopsy curette, like mass radiography, reveals unsuspected disease, a considerable literature is accumulating on the relation of tuberculosis to infertility. It has been ably summarized by Jameson (1935), Sutherland (1950a), and Jedberg (1950). In the Oxford series, infertility was the main complaint in 57 per cent, but in 20 per cent of these cases there were associated gynaecological symptoms. Russell *et al.* (1951) noted an incidence of 62 per cent, Sutherland and Garrey (1951) 34 per cent, and Jedberg (1950) 35.5 per cent.

Pregnancy with active endometritis or salpingitis is rare. This is easy to understand when tubes are disorganized (Fig. 1) but much more difficult when they are patent and function normally. There was only one pregnancy in the Oxford series. The diagnosis of endometrial tuberculosis was made from a positive culture in the early days of pregnancy, before its presence was suspected, in a woman with prolonged amenorrhoea. There was also one case of acute puerperal tuberculous peritonitis, with endometritis and salpingitis discovered 36 hours after delivery. The infection must have been present during at least the later weeks of pregnancy. Similar cases following parturition and abortion have been reported by Holtz (1940), Jedberg (1950), Russell *et al.* (1951), and Sutherland (1952). Ectopic pregnancy in a tuberculous tube has been described by Bland (1940), Kovacs (1943), Sutherland and Garrey (1951), and Cope (1952) showed a specimen at a meeting of the Royal Society of Medicine, but considering the incidence of pelvic tuberculosis during the childbearing years the association of infection and pregnancy is rare indeed.

(3) *Menstrual disorders.* Contrary to general belief, menstruation is normal in approximately 50 per cent of these patients. Menorrhagia is the most common complaint with an associated irregularity in about half the cases, while oligomenorrhoea occurs, with or without irregular bleeding, in approximately 10 per cent. Amenorrhoea is rare, but may occur with activity elsewhere, or with an old-standing fibrocaseous endometritis.

The practical point to emphasize is that the endometrium should be examined in every patient with disordered menstruation of more than short duration, for both tuberculosis and carcinoma occur even in the very young. *Hormone therapy without preliminary endometrial studies cannot be justified.*

(4) *Pain.* Pain is not usually a prominent symptom and is present in approximately half the cases, although in Jedberg's series it was acute in over 30 per cent. Severe pain is frequently associated with pyrexia, suggesting secondary pyogenic infection which may follow tubal patency tests, or result from autogenous invasion by coliform organisms. Pain is typically hypogastric with a uterine infection, and referred to the iliac fossae with adnexal disease. Sacral backache is common with pelvic peritonitis of the exudative type, due to infection of the uterosacral ligaments. Failure to diagnose underlying tuberculosis in these cases may lead to tragedy, and to drain as recommended by Russell *et al.* (1951) is to invite disaster. This is discussed more fully later, but at this stage a note of warning is justified. *If a woman has adnexal inflammatory masses, unilateral or bilateral, subacute or chronic, with no history of infection, the possibility of tuberculosis should be investigated before abdominal section is performed.* Particularly is this so if she is nulliparous or virginal.

(5) *Peritonitis.* This may complicate salpingitis and endometritis, or be primary with secondary infection of the genital organs. Only the serosa may be affected and pregnancy can follow healing if tubal function is unimpaired. There was one such case in the Oxford series.

Peritonitis may be ascitic or plastic and either may be insidious or acute. A useful sign sometimes detected with light palpation through a thin abdominal wall is a finely granular sensation due to miliary tubercles on the parietal peritoneum. Malignant deposits can occasionally be similarly palpated.

(*a*) *Insidious form.* This is the more common. The victim, usually young, complains of lassitude and an increasing swelling of the abdomen which may vary in size from day to day. Anaemia is common, and there may be mild pyrexia, but loss of weight is unusual. The sedimentation rate is seldom raised unless secondary infection has occurred or there is associated pulmonary activity. The ascites, if encysted, may be diagnosed incorrectly as an ovarian cyst but the finding of restricted uterine mobility or an adnexal mass should lead to the provisional diagnosis of tuberculosis.

(*b*) *Acute or subacute peritonitis.* This is less common, but may follow parturition or abortion. There was one Oxford case and others have been reported by Fruhinsholz *et al.* (1941).

The Oxford patient, para 3, aged 32, was admitted with peritonitis 36 hours after normal delivery. The diagnosis was confirmed by laparotomy, and with sanatorium treatment recovery was apparently complete. Two years later, severe menorrhagia associated with tuberculous endometritis was treated by total hysterectomy and bilateral removal of the adnexa. Recovery was uneventful and the patient is extremely well 7 years later.

(6) *Fistulae.* A high mortality has been accepted in the surgery of genital tuberculosis, and fistulae are frequent. It will be shown that this need not be, and that there is a common cause for both unfortunate sequelae. Schmitz (1943) reported an operative mortality of 7–8 per cent and a fistula incidence of 5–10 per cent. Similar results were announced from Edinburgh (Callam, 1950), and Jedberg (1950) described a 14 per cent incidence of postoperative fistulae.

Faecal are the most common, but both uterine and vesical fistulae occur. They usually follow inadequate surgery, particularly with drainage, but may arise spontaneously due to rupture of a pyosalpinx through the abdominal wall, into the colon, or into the bladder. The cure of one woman with a spontaneous vesicocolic fistula is described later. A woman of 26, with a double faecal fistula and a uterine sinus through which she menstruated on to her abdominal wall, was another who made a good recovery before the advent of antibiotics. These followed drainage of a pyosalpinx.

(7) *Postmenopausal bleeding.* This is a rare manifestation of tuberculosis. We have seen only one case, due to a proliferative endometritis. Complete recovery followed total hysterectomy and bilateral salpingo-oöphorectomy.

Diagnosis of Pelvic Tuberculous Disease

It has been accepted for too long that the diagnosis of pelvic tuberculosis is difficult. True it may be, but when the possibility of its presence is kept constantly in mind tuberculosis will be seldom missed. Although a correct provisional opinion can often be given, the final diagnosis depends on bacteriological confirmation.

In no gynaecological condition is a careful and accurate history more important. There is a family tuberculous history in approximately 20 per cent, and a personal record of pleurisy, pulmonary, or abdominal infection in nearly 50 per cent of these patients. Associated active lesions occur particularly in the chest and peritoneum, and O'Driscoll (1951) has emphasized the need for closer collaboration between physician and gynaecologist. Strangely enough the association of renal and genital tuberculosis is less common. Pelvic tuberculosis should be suspected when menstrual irregularity is associated with a personal or family history of this infection.

Clinical Signs

There may be no abnormal findings. Adnexal masses when present are usually small and adherent but are sometimes large and mobile, and may be mistaken for ovarian cysts. They may even undergo torsion. A tubo-ovarian mass of restricted mobility, particularly in a nullipara or virgin with no history of infection, is very suggestive of tuberculosis and should be investigated bacteriologically before operation. This precaution would prevent many disasters. Neither laparoscopy nor culdoscopy was used in the Oxford series.

When tubal thickening or tenderness is detected in infertility patients, or there is a history of tuberculosis, patency tests are postponed until the endometrium has been examined. The biopsy curette is used to avoid the risks attendant on dilatation and curettage. The general health of the patient is assessed with

particular reference to the clinical, radiological, and bacteriological examination of the chest and urinary tract. Cystoscopy is performed when indicated.

If infection is not suspected salpingography may reveal the first evidence of disease. Magnusson (1945, 1947) assesses the value of radiological diagnosis and describes two typical pictures. The first is a ragged irregular tubal outline with filling defects and fistula-like extensions into the surrounding tissue (Fig. 2). Adenomyosis can produce a similar picture. The second is a rigid pipeline tube (Fig. 3). Diverticular penetrations into the myometrium were described in tuberculous endometritis by Robins and Shapira (1931), and Williams (1948) drew attention to tubal obstruction due to calcified debris. Ekengren and Rydén (1950) made repeated radiological examinations during treatment with antibiotics. They decided that healing occurs by fibrosis with multiple strictures often obliterating the lumen, observations which, if confirmed, would destroy the hope I expressed in 1950 that pregnancy might follow cure by streptomycin or other therapeutic agents.

O'Brien and Lawler (1947) drew attention to the danger of salpingography. Rabau *et al.* (1943, 1949) and Halbrecht (1946) had previously warned of this, and later repeated the warning. The evidence now suggests this danger is greatly reduced by using water-soluble contrast media.

Steps in the diagnosis of genital tuberculosis are summarized in Table I.

TABLE I

Genital Tuberculosis: Diagnosis

(a) PROVISIONAL DIAGNOSIS	
(1) Personal history	Infertility Menstrual disorders
(2) Clinical manifestations	Pain Peritonitis
(3) Histological evidence	Fistulae
(4) Salpingography	Postmenopausal bleeding
(b) FINAL DIAGNOSIS	
Bacteriological:	Animal inoculation Culture

TREATMENT

The measures available are summarized in Table II but before discussing these the following points are emphasized:

(1) As the bacteriological diagnosis of pelvic tuberculosis has been developed only recently and criteria of cure are still uncertain, the results claimed for sanatorium treatment must be regarded as not proven.

(2) Surgery has been associated with a high mortality and a high incidence of postoperative fistulae.

(3) It is often impossible to recognize tuberculosis of the tubes, ovary, or uterus with the naked eye. Even when characteristic tubercles are present it is always impossible to assess by inspection the extent of infection.

(4) The secretions of an infected uterus may contain the mycobacterium, and at operation direct infection of the abdomen and wound can occur unless adequate precautions are taken.

(5) Salpingitis can occur without endometrial infection.

Failure to appreciate these basic facts is responsible for bad results.

TABLE II

Genital Tuberculosis: Treatment

(1) Sanatorium and heliotherapy	
(2) Radiation	
(3) Surgery:	Conservative Radical
(4) Antibiotics	

The only Oxford cures, except one, before the advent of streptomycin were obtained surgically and the only death was in an untreated case. Although patients had been kept under observation without treatment (other than a disciplined life) for as long as 10 years there was only one spontaneous cure. Clinically demonstrable spread of infection occurring even during sanatorium treatment was ultimately cured surgically, and there were no surgical failures. It was concluded, therefore, that surgery had an important part to play in treatment and if any contribution has been made by the Oxford work on genital tubercu-

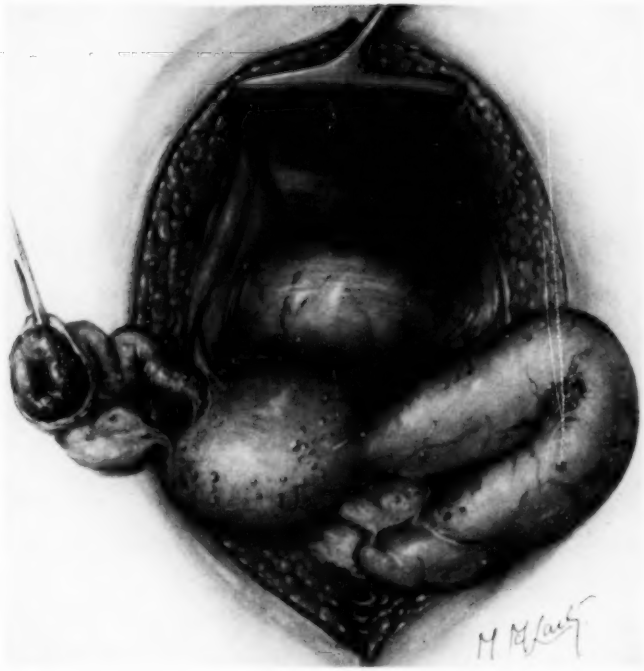

FIG. 1
Tuberculous uterus and adnexae.

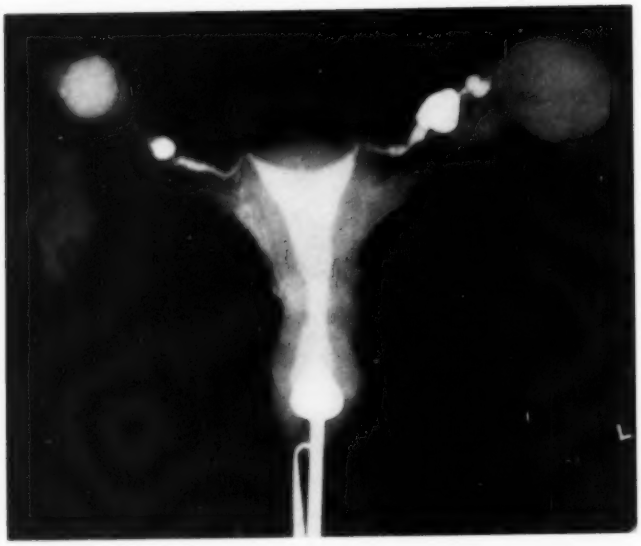

FIG. 2
Tuberculous uterus and tubes injected immediately after removal.

FIG. 3
Tuberculous salpingitis.

FIG. 4
Injection of tuberculous faecal fistula before barium enema.

FIG. 5

Injection of tuberculous faecal fistula with barium enema.

losis it is in connexion with the safe use of surgery.

In view of the facts outlined above it seemed reasonable to attribute the bad results generally reported to inadequate surgery in which infected tissue was incised, as in salpingectomy, subtotal hysterectomy, and ovarian conservation, when the uterus and adnexae were infected. Our practice, therefore, became more radical, and the tuberculous uterus was treated like the malignant one with a corpus carcinoma. The cervix was packed and sutured to avoid spilling infected material, and a total hysterectomy and bilateral salpingo-oöphorectomy was performed. One patient appeared to have a transient postoperative rectovaginal fistula, although this could not be demonstrated even under anaesthesia. She complained for some weeks of a recurrent passage of flatus *per vaginam* but has since been perfectly well for over 5 years.

The objection to the treatment advocated is its radical nature and for that reason operation was advised only for certain well-defined indications:

(1) In the menopausal or postmenopausal patient, without activity elsewhere.

(2) If adnexal masses appeared or increased in size during conservative treatment.

(3) For fistulae which failed to heal.

(4) When menorrhagia impairing health was associated with endometritis.

The remaining cases, which constituted more than half the total, were kept under regular 3- to 6-monthly observation with the immediate but vain hope of spontaneous cure, and with a remote confidence in the discovery of effective therapeutic substances.

When streptomycin and P.A.S. became available they were used with the encouraging results already reported (Robertson and Stallworthy, 1950). Dr. Sutherland will refer to streptomycin therapy, so I merely mention it, emphasizing that it is in the early days of trial and disappointments are likely.

We have treated 29 patients with streptomycin. Recurrence of infection has occurred in several after they were "cured" by the criteria Dr. Sutherland will discuss. If Ekengren and Rydén are correct, and the healed tube is disorganized, antibiotic therapy will require careful reviewing. There would seem little justification for leaving functionless structures with the risk of recurring infection. It is too early to report progress with isonicotinic acid hydrazide, but as there is evidence that it may be more bacteriostatic than bacteriocidal it may need to be used in association with other therapeutic agents.

Treatment of Fistulae

The incidence will be reduced if the principles outlined today are more generally adopted. When fistulae occur they can severely tax surgical skill and experience. Corston (1952) cured a vesical fistula with calciferol, 100,000 units daily for 6 weeks. Ellman and Anderson (1948) reported a remarkable cure with ostelin. Sanatorium routine, the use of P.A.S. and streptomycin, possibly aided in refractory cases by radiation, should be tried.

In pelvic tuberculosis, faecal fistulae are particularly liable to arise from the pelvic colon, and may be multiple. If infection and fibrosis produce bowel stenosis spontaneous cure is unlikely and surgery is indicated. The extent of the sinuses, and the segment of the bowel affected, can be revealed radiologically after the injection of a radio-opaque material (Figs. 4 and 5) combined with a barium enema.

Before operation the patient is made as fit as possible. This may take months. The bowel is sterilized by phthalyl-sulphathiazole or oral streptomycin for 48 to 72 hours. The fistulous tracts are excised with a wide margin of healthy tissue, and the affected segment of gut resected with as liberal a portion of healthy intestine above and below as is technically advisable. If uterine fistulae are present their excision is combined with total hysterectomy and bilateral salpingo-oöphorectomy, using the technique already described. A case of each of the above types of fistula was successfully treated in the Oxford series before streptomycin was available.

The possible combination of antibiotic substances with conservative as opposed to radical surgery, is illustrated by the following case:

A woman, aged 37, ruptured a tuberculous pyosalpinx into her bladder and pelvic colon. Faeces were passed *per urethram*. Pelvic examination revealed

a unilateral pyosalpinx with the uterus densely adherent. There being no history of infection the correct diagnosis was made of tuberculous disease. The bladder and endometrium were heavily infected. With streptomycin 1 g. daily for 3 months the pyosalpinx completely resolved but the fistulae persisted. The uterus, now mobile, was enlarged to the size of a 10-weeks gestation by a posterior wall fibroid. The patient was anxious to avoid hysterectomy, and as 3 negative cultures were obtained it was agreed that the operation would be as conservative as possible. Oral streptomycin was given for 2 days, the affected loop of sigmoid colon was excised, myomectomy was performed by Bonney's hooded technique, and the posterior flap was used to extraperitonealize the indurated bladder fistula (Fig. 6). This was completely successful. There was no leakage of urine, and the patient 18 months later is perfectly well.

The results of treatment are summarized in Table III. The 8 patients who became worse on conservative measures were cured surgically.

TABLE III

Genital tuberculosis: Results of treatment

Method	Number	Cured	Worse	Deaths	Untraced
Sanatorium or regulated life	12	0	7	0	1
Untreated (controls)	22	1	1	1	5
Streptomycin and P.A.S.	25	7	0	0	0
Surgery	27	27	0	0	0
Total	86	35	8	1	6

The 12 patients included in the first column were kept under observation for long periods up to 10 years before streptomycin. The 22 untreated cases are more recent ones.

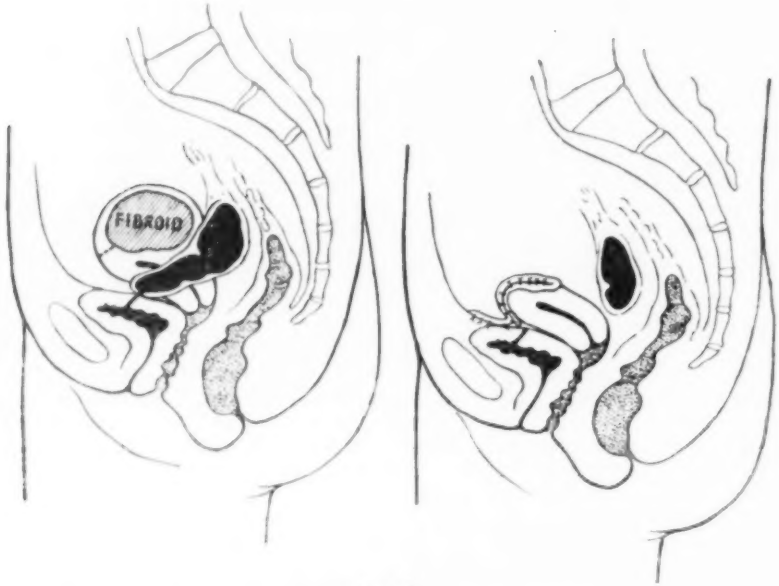

FIG. 6

Tuberculous vesico-colic fistula treated surgically

The Future

It is hoped that with the extended use of immunization, the earlier recognition and treatment of pulmonary lesions, and long overdue reforms in the hygiene of food production and distribution, genital tuberculosis will become progressively less common.

New treatments should be controlled bacteriologically until the most effective measures are determined. These may consist of antibiotic substances, either alone or in association with agents such as P.A.S. and the nicotinic acid derivatives. Radiotherapy may have a greater part to play in the future, or surgery, with the safeguards outlined earlier, may be more widely used.

Summary

(1) Many women with unsuspected pelvic tuberculosis lead apparently healthy lives.

(2) All active pelvic tuberculosis is serious and even the unsuspected case can prove fatal.

(3) Absence of physical signs does not improve the prognosis, and conversely the presence of adnexal masses does not make it worse.

(4) The correct diagnosis can usually be made before operation.

(5) Until new preparations have been adequately assessed treatment should consist of general measures to improve health, and streptomycin with P.A.S.

(6) The place of radiotherapy is not at present clearly defined.

(7) Surgery should be avoided unless: (*a*) adnexal masses develop or increase in spite of the above measures; (*b*) menorrhagia associated with uterine infection delays recovery; (*c*) fistulae fail to heal.

(8) Operation when indicated should be carefully planned in extent and timing. Radical surgery gave good results before antibiotics were available. Conservative surgery has been associated with a high mortality and fistula incidence, but its place in the future with the combined use of antibiotic substances is still to be determined.

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DISCUSSION

PROFESSOR B. S. TEN BERGE (Holland)

I AM grateful to have been offered the opportunity of giving our point of view on diagnosis and therapy, two aspects on which there may be difference of opinion.

Diagnosis. To the aids to diagnosis has been added the examination of the menstrual secretions by histological and bacteriological methods.

In our opinion a curettage with suction, performed on one of the last days preceding, or the first day of, the menstrual period will give more certain results than sucking out blood from the vagina. In addition it will be possible in a number of cases to make a diagnosis from a histological examination of the curettings, a saving of time which will favourably influence the treatment. The bacteriological examination is carried out by culture on Löwenstein's medium and inoculation of guinea-pigs. This latter procedure takes 6 weeks, but seems to be more reliable. The tubercles develop more strongly in the second half of the cycle, chiefly in the superficial layers of the mucosa. It is important to examine this tissue, which is obtained by means of the suction curette. It is possible to recognize histologically a caseous endometritis, which must be operated on, whereas in disseminated tuberculosis of the uterine mucosa treatment should be conservative as regards the uterus.

It is important to be very careful in the carrying out of a suction curettage. A thin flexible tube is used which is introduced without dilatation of the cervical canal and without traction on the cervix. Notwithstanding these precautions 2 patients developed a temperature, which disappeared after treatment. But this happened during the time that dilatation was not strictly forbidden and I am not quite sure that those 2 cases were properly treated. We encountered no complications during the past year. It is desirable that this operation should be carried out under the protection of an appropriate antibiotic umbrella, given for the preceding 5 days. In the presence of a large area of infiltration it will be sufficient to examine menstrual blood sucked out from the vagina. The chances of a positive result are better here, whereas suction curettage is more likely to cause complications.

We have confirmed the diagnosis of tuberculosis of the uterus, or of the adnexa, on 106 occasions by suction curettage. We conclude that histological examination is as necessary as culture of the bacillus, for we have cases in which culture was negative whereas the histological evidence was positive. My co-worker, Miss Maas, found a positive menstrual secretion in 3 out of 87 sanatorium patients suffering from pulmonary tuberculosis and in those 3 women palpable tuberculous abnormalities of the adnexa were detected.

The Dutch investigators, Schut and Feenstra, carried out an investigation in a sanatorium for tuberculosis of the bones. They found positive menstrual blood in 66 patients (30 per cent). We propose to carry out a similar investigation. It would seem that all tuberculous women should be gynaecologically examined, but we have stopped making hysterograms in cases of genital tuberculosis because of the risk of activating the process.

Infertility. In the investigation of infertile women, we examine the menstruating mucosa histologically before making a salpingogram. If there is a history of tuberculosis we also carry out a bacteriological examination. Even this precaution is not sufficient, for 2 patients were subsequently found to have a tuberculous salpingitis and one of them was later discovered to be positive on guinea-pig inoculation with menstrual secretion.

We no longer use lipiodol. The same result can be obtained with watery contrast media and the liquid is absorbed in a few hours. Lipiodol remains *in situ* for a long time, and is broken down slowly into irritant substances, a fact which we have confirmed histologically.

I have seen a flare-up in both tuberculous and non-specific salpingitis after lipiodol injections and one patient with tuberculous salpingitis died as a result of such a flare-up.

We never perform operations for sterility on tuberculous tubes, nor when the shape of the tube makes the presence of tuberculosis a probability, although the process may have been arrested. Too much of the wall of the tube is destroyed by the process and we can hardly expect any results from the operation.

In the event of complications arising in pregnancy associated with tuberculosis of the uterus or tubes, medical treatment should be intensive and rapid, but operation may prove necessary. This complication increases the mortality as is shown in the literature (Wharton, 11 women died out of 24; Rielferscheid, 5 deaths out of 14, of which the course of the disease was known). A thorough examination of the operation specimens of tubal pregnancy and of curettage for abortion is imperative. Infection after delivery or abortion, which does not respond to penicillin, must lead to suspicion of tuberculosis, which proved well founded in 2 of our patients.

Treatment. The treatment of tuberculosis has been changed by the use of the antibiotics, improved surgical technique, and modern anaesthesia. Purely conservative therapy can be replaced with advantage by conservative selective operative treatment.

One formerly operated only in cases of dire necessity. The operation was dangerous, was performed through tuberculous tissues, which led to increased risks, and a residual fistula was a common occurrence.

Between 1939 and 1949 I operated on 21 patients with tuberculosis of the internal genitalia and of these 2 died and 3 were left with fistulae.

We obtained good results in the past with the so-called " postalhorn tubes ". These tubes are enlarged and filled with tuberculous " cheese " and are fairly free from adhesions. The ovary is usually free and can be saved. One did see dissemination of tubercles on the pelvic peritoneum, but these as a rule disappeared when the tuberculous foci were removed. We still operate on such tubes after a short medical preparation.

It is much more difficult to remove the infiltrative types. Around the centre containing caseous material there is a thick wall of tuberculous tissue, to which the surrounding intestines are adherent. These processes are very stubborn and exacerbations may be expected. Pre-operative medical treatment can lead to absorption of the surrounding tuberculous infiltration, leaving an infected mass in the centre where the antibiotics cannot penetrate in sufficient concentration. These foci can be removed without risk after due pre-operative treatment, and the uterus, together with ovarian tissue, can usually be conserved.

For this treatment we use P.A.S. and for the past few months isonicotin-hydrazidum. We usually give 2 courses of these drugs for 6 weeks, separated by an interval of 2 weeks. Streptomycin is now only used in exceptional cases, owing to the risk of the organisms becoming resistant to the drug.

All patients are given sulfasuccidine before operation. Postoperatively they receive streptomycin for about 7 days, followed by P.A.S. or isonicotin-hydrazidum, for the following 2 or 3 months.

Operative results obtained since using streptomycin and P.A.S. Number of operations: 19. There were no deaths and but one postoperative fistula. Eighteen patients were under the age of 40, and on 15 occasions both the uterus and ovarian tissue were conserved. One patient who was not treated postoperatively with streptomycin and P.A.S. relapsed, but all the others

recovered and menstruated normally. On 3 occasions the uterus and both adnexa were removed; of these 2 demonstrated caseous endometritis, while in the third all ovarian tissue was destroyed. In one case I implanted the ovary in the uterus.

It is thus clear that the pre- and post-operative use of streptomycin and P.A.S. makes conservative surgery possible.

Several patients were referred to us by the chest physician because the patients failed to improve notwithstanding the amelioration of the lung infection. Improvement in their general condition followed removal of tuberculous foci in the abdomen.

The indications for operation are:

(1) A tumour of the adnexa of 5 cm. diameter or more, providing the swelling is mobile.

(2) Caseous endometritis.

(3) The presence of a fistula, leading to exhaustion, when spontaneous recovery can no longer be expected.

(4) Advancing inflammation, when the resistance of the patient appears to be low, notwithstanding the treatment with anti-tuberculous drugs.

The fistula undermines the condition of the patient either through secondary infection or malnutrition, and should be closed after preparatory treatment with rest, diet and the drugs already mentioned, together with sulfasuccidine or aureomycin.

Operations to deal with fistulae are difficult, but thanks to the antibiotics the results are now better, as is shown by the following example. A medical student, 27 years of age, had been ill for 2 years. When I saw her, both adnexa were tuberculous and the size of ducks' eggs. There was, in addition, an opening in the vaginal wall behind the uterus, from an earlier colpotomy. Faeces, which appeared to come from fistulae both in the caecum and in the rectum, poured into the vagina. The uterine mucosa was free from tuberculosis. After preparation of the intestine with sulfasuccidine the right adnexus was removed entirely. On the left side we removed a pyosalpinx, and conserved the ovary. The caecal fistula was resected and closed. It was not possible to close the rectal fistula. We therefore divided the intestine between the sigmoid and the rectum. The proximal end was mobilized and brought through the distal part. The patient recovered completely and menstruates normally. The remaining ovary appears to be normal 2 years after the operation.

This pull-through method of Hochenegg-Kocher, which was originally used in the operation for carcinoma of the rectum, would appear to be very useful in the treatment of fistulae. I also used this method successfully in a case of carcinoma of the cervix which had invaded the rectum.

DR. ARTHUR M. SUTHERLAND (Glasgow)

THIS communication consists of a brief preliminary report of the results obtained with streptomycin and para-aminosalicylic acid in the treatment of genital tuberculosis in women. Most of the cases in this report form part of a larger investigation, which is at present in progress in a number of British centres and is being conducted under the joint auspices of the British Tuberculosis Association and the Royal College of Obstetricians and Gynaecologists. The results of this investigation will be published in due course.

Present series. So far the present series consists of 75 cases of histologically proved genital tuberculosis in women, which were investigated during a period of 18 months. The majority were under the personal care of the writer in the Southern General Hospital, Glasgow, and the remainder were under the care of Dr. Garrey, in the Royal Samaritan Hospital for Women, Glasgow. The fact that so many cases have been seen in such a relatively short period of time is due principally to the splendid co-operation of many colleagues throughout the West of Scotland.

Individual lesions. In one patient the tuberculosis was apparently limited to the cervix, and no evidence of tuberculous infection of the other pelvic organs was found. Endometrial tuberculosis was present in the other 74 cases and a variable degree of adnexal thickening was found in 39 instances. A cervical erosion was present in 9 of these patients; cervical biopsy

was performed in each case and tuberculosis of the cervix was discovered on 3 occasions. This suggests that cervical tuberculosis may be more common than is generally realized and emphasizes the need for cervical biopsy in cases of known genital tuberculosis with cervicitis.

Tuberculosis of other organs. Guinea-pig inoculation with the centrifuged deposit from a catheter specimen of urine was carried out in 74 patients, and a positive result has so far been obtained in only 1 case. X-ray examination of the chest was performed in every case. Active pulmonary tuberculosis was discovered on 2 occasions and quiescent pulmonary lesions were found in 28 instances.

Bacteriology. Guinea-pig inoculation with endometrium was carried out in 72 of the 75 cases. In 43 instances the result was positive, in 21 the result was negative, and in the remaining 8 cases the results are still awaited. It is considered that the very small amount of tissue obtained by curettage in many cases may be the main reason for the high number of negative results.

Culture media were inoculated from all positive guinea-pigs. A positive result was obtained in 35 instances and the results from 4 further cases are not yet available. In all 35 cases the tubercle bacillus was found to be of the human type. In every instance the organism was found to be streptomycin-sensitive, though in 3 cases the sensitivity was only partial.

Treatment. Forty-six patients have been treated with streptomycin and P.A.S., and in a number of these the treatment is still in progress. The dosage employed has been identical throughout, namely 1 g. of streptomycin daily for 84 days and 3 g. of P.A.S. 4 times daily over the same period. This dosage has produced little or no disturbance in most of the patients treated. In 3 cases, however, it has been found necessary to discontinue the treatment before completion of the course. Two patients developed slight vestibular disturbance after 52 and 27 g. of streptomycin respectively, while a third had a severe generalized skin eruption, with loss of most of the hair from her scalp, after 22 g. When treatment was stopped in the last case, the skin condition rapidly improved and her hair has now returned to normal.

In 3 further cases, the initial dilatation and curettage were followed by the development of pelvic peritonitis within a few days of the operation. It seems worthy of mention that tubal insufflation had also been performed in 2 of these patients. Following the institution of treatment with streptomycin and P.A.S., the acute condition subsided rapidly in each case. It has not so far been considered desirable to carry out further curettage or endometrial biopsy in any of these patients. The patient with tuberculosis apparently limited to the cervix was given a full course of treatment; 6 months later cervical biopsy showed no evidence of tuberculous infection.

In the remaining 39 cases, an attempt is being made to assess the progress of the condition by carrying out examinations of the endometrium at regular intervals. Whenever possible, premenstrual endometrial biopsy is performed halfway through treatment, at the end of treatment, 3 months after treatment, and 6 months after treatment. At the end of a year from the commencement of treatment, dilatation and full curettage are carried out. Approximately half of each specimen obtained is used for histological examination and the remainder is used for guinea-pig inoculation.

In many of these patients the histological follow-up is still in progress and in no case are the full bacteriological results so far available. In 10 cases the histological follow-up has been completed. In 7 of these there has been no further evidence of endometrial tuberculosis, while the condition has recurred in the remaining 3 patients. A partial follow-up is available in 16 further cases; 15 have so far remained free of infection, and the last case has shown recurrence. In the remaining 13 cases, treatment is still in progress. In all 3 cases in this group with cervical tuberculosis, the cervical condition has been found to be healed at subsequent examinations.

Control cases. It was decided to include control cases in this investigation, with the following provisos:

(1) All control patients who are still active at the end of a year should receive the full course of treatment.

(2) All control cases showing any clinical deterioration should receive treatment at once.

(3) Patients with active tuberculous lesions in other organs should not be used as controls.

(4) All cases in which it was felt that it might be harmful to withhold treatment should be treated at once.

There were 29 cases in the control group. One patient was removed from this category because she was found to have a tuberculous infection of the urinary tract, and a second patient was excluded after a few weeks in the group, because of increasing abdominal pain. A third patient failed to report on several occasions and it was recently learned that she is in another hospital with tuberculous meningitis.

Six of the remaining 26 control patients have completed a year of follow-up. The endometrium was still histologically positive in 4 and negative in the other 2. In 11 further cases, the follow-up is not yet complete; 9 of these are still positive and only 2 are negative. In the remaining 9 cases, no follow-up is so far available. An important point is that 2 of the control patients, who were later treated, developed evidence of vestibular upset after 55 and 30 g. of streptomycin respectively.

Conclusions. Although this is only a preliminary report, it will be apparent that the early results with streptomycin and P.A.S. in the treatment of genital tuberculosis in women are encouraging, in spite of the development of toxic manifestations in 5 of the patients during treatment. It is the writer's intention to follow-up these patients as long as they can be persuaded to attend, and the long-term results are awaited with great interest.

The question of treatment with new nicotinic acid derivatives is now under consideration and several of the earlier streptomycin failures are about to be treated with one of these preparations.

Dr. Albert Sharman (Glasgow)

The first report on the relation of unsuspected endometrial tuberculosis to sterility was made by Steinsick in 1922, and the present communication concerns 173 cases of endometrial tuberculosis in 3,255 primary sterility cases submitted to biopsy or curettage, an incidence of 5.3 per cent.

The age of the patients in the series ranged from 19 to 43 years, there being only one of each of these ages. Almost 70 per cent (119) were between 20 and 30 years of age. In none of these cases was pelvic tuberculosis diagnosed or suspected before endometrial biopsy. Almost all were noted as enjoying good health. The results of radiography of the lungs are shown in the following table:

Previous health	No. of cases	No. X-rayed (lungs)	Cases showing lung tuberculosis	
			Healed	Active
Pleurisy	13	12	6	–
Non-pulmonary tuberculosis	9	6	1	–
Appendectomy	21	10	5	–
No relevant illness	130	64	3	2

Seven patients with a history of tuberculous abdominal glands or peritonitis are of particular interest. In 4 of them laparotomy at the respective ages of 16 years, 17 years, 22 years, and 24 years had revealed the condition. Two of the remaining patients had been for several months in sanatoria at the age of 14 years. The diagnosis was made in the seventh case at laparotomy in the Royal Hospital for Sick Children, Glasgow, at the age of 3 years and 5 months.

It is not proposed to discuss the details of each of the 173 cases of the series, but it is of particular interest to note the biopsy details in cases in which 3 or more biopsies were performed over a long period of time, i.e., 2 years or over. The dates and results of the endometrial biopsies are given in the list opposite.

The list begins with several cases who were positive on every examination, in one instance over a period of 7¾ years. There are then listed 2 cases in which negative findings intervened between positive findings, the intervening negatives numbering 3 in one instance (Case No. 469). In view of the findings in the latter case, the next cases in the list, namely those who findings ended with only 1 or 2 nega-

tives, cannot be regarded as healed. For the same reason 2 cases might suggest possible arrest or healing of the endometrial disease, 4 successive negatives having been obtained. Case No. 338 was 29 years old at first attendance, came from a mining area, had a history of pneumonia at the age of 4, and had closed tubes, insufflation having shown non-patency on 5 separate occasions over a period of 15 months; on the occasions of both the second and third biopsies serial sections were examined. Her endometrial infection was due to the bovine bacillus. When she attended for her last investigation, she reported having had "pleurisy" a few months after her fourth biopsy. It is obvious that a great deal of further work will have to be reported before criteria of arrest or cure can be set up and before we can say whether conversion to negative of the endometrium necessarily indicates improvement of tubal disease. Any argument that conversion to negative of the endometrium connotes tubal improvement will have to be carefully substantiated; for we know that in many cases of gross tubal tuberculosis no evidence of endometrial infection can be found. It may be added at this point that 2 further cases, in each of which 2 biopsies were done, showed evidence of endometrial tuberculosis persisting after 13 and 8 years respectively.

Although it was considered most improbable that curettage of a tuberculous endometrium would "cure" the condition, studies were carried out to observe the post-curettage recurrence of the tubercle follicles and to determine its time-interval. Four sterile patients were investigated. Tuberculous endometritis was found to have recurred at the following intervals after thorough curettage under anaesthesia: 20 days, 27 days, 34 days, and 3 months. The question naturally arises as to the location of the focus from which re-infection occurs. Jameson (1935) suggested that it may be from diseased Fallopian tubes; indeed Solomons (1935) states that removal of tuberculous Fallopian tubes means a cure of tuberculous endometritis. It was felt that further investigation of the matter was essential and it was therefore decided to remove tuberculous tubes and to do follow-up endometrial biopsies in the first suitable cases of known endometrial tuberculosis which presented themselves.

Case No. 21
1. 10/9/35, tubercle positive
2. 28/6/38, tubercle positive
3. 6/5/43, tubercle positive

Case No. 347
1. 18/4/40, tubercle positive
2. 24/2/42, tubercle positive
3. 29/8/46, tubercle positive

Case No. 437
1. 2/ 8/39, tubercle positive
2. 29/ 1/42, tubercle positive
3. 12/11/45, tubercle positive

Case No. 393
1. 11/ 5/39, tubercle positive
2. 19/ 5/39, tubercle positive
3. 3/11/41, tubercle positive

Case No. 146
1. 22/ 8/36, tubercle positive
2. 2/12/37, tubercle positive
3. 25/ 8/41, tubercle positive

Case No. 469
1. 15/ 4/40, tubercle positive
2. 31/ 7/41, tubercle negative
3. 7/ 8/41, tubercle negative*
4. 27/ 8/41, tubercle negative
5. 17/ 3/42, tubercle positive

Case No. 98
1. 26/11/35, tubercle negative
2. 26/ 5/37, tubercle negative*
3. 22/12/37, tubercle positive
4. 26/10/39, tubercle negative*

Case No. 338
1. 30/11/38, tubercle positive
2. 25/ 1/39, tubercle negative
3. 27/ 3/39, tubercle negative
4. 25/ 5/39, tubercle negative
5. 19/ 2/42, tubercle negative

Case No. 452
1. 26/10/39, tubercle positive
2. 18/12/39, tubercle negative*
3. 24/ 2/42, tubercle positive
4. 21/ 8/46, tubercle negative*

Case No. 549
1. 21/12/39, tubercle negative
2. 4/ 3/40, tubercle positive
3. 28/ 3/40, tubercle positive
4. 17/ 2/42, tubercle negative

Case No. 76
1. 20/ 6/35, tubercle negative*
2. 9/11/37, tubercle negative*
3. 16/11/37, tubercle positive
4. 23/11/37, tubercle negative*

Case No. 394
1. 25/ 5/39, tubercle positive
2. 17/ 8/39, tubercle negative*
3. 29/ 1/42, tubercle negative*
3. 29/ 9/50, child born
4. 4/ 1/51, tubercle negative
5. 4/ 3/51, tubercle negative

* But with microscopic evidence of chronic endometritis.

Findings in 4 cases so treated, however, proved that removal of tuberculous Fallopian tubes does not cure endometrial infection, and that while the tube may be a source of re-infection it is not the only one. The suggestion therefore arises that re-infection after curettage may occur from tubercles remaining in the unremoved basal layer, or, assuming that there is a shedding of all tubercles at menstruation, re-infection may occur from infected mucus or blood in the uterine cavity. The possibility of cure of endometrial infection by curettage must be considered remote, despite the fact that a number of writers state that this may happen.

In 149 of the series of 175 cases, tubal insufflation was performed and showed non-patency in 98 (65.8 per cent). In the earlier cases the diagnosis of non-patency was often made as the result of a single test, the limit of pressure used being 200 mm.Hg. The possible fallacy of single-test negative diagnosis and its extent have been discussed by Sharman (1950). During recent years a much more strict minimal criterion has been established as a routine in the investigation of patency—2 negative insufflations and a negative hysterosalpingogram—and the limit of pressure has been raised to 250 mm.Hg. In known cases of endometrial tuberculosis, hysterosalpingography and repitition of insufflation are now omitted as these procedures are not without risk of spreading the infection.

Since the pathologists tell us that endometrial tuberculosis is virtually without exception secondary to tuberculosis of the tube, and since the endometrium often escapes infection even when the tubes are the seat of gross tuberculous lesions, it is certain that the incidence of tubal tuberculosis, in my series, is much higher than the recorded incidence of 5.3 per cent of endometrial infection. It is suggested, therefore, that tubal tuberculosis of a degree not sufficient to be recognizable except on laparotomy—and even then often only on microscopical examination—is responsible for a much greater number of cases of tubal non-patency than is generally recognized.

A follow-up of 145 patients who were under observation for more than 1 year has shown that, of 127 traced, only 1 sterility patient with endometrial tuberculosis became pregnant. Many have been followed up for from 5 to 8 years and one for 13 years. Salpingostomy has had no success. It would seem that in cases of endometrial-tubal tuberculosis the restoration of fertility is highly improbable.

The present follow-up has shown that only 1 death occurred from tuberculosis, in the case of the patient with a previous history of Pott's disease. The spinal infection apparently flared up later and death occurred 3 years after her attendance at the sterility clinic. Almost all the remaining patients continued in apparent good health. Very few reported any complaint other than continued infertility.

In conclusion, reference must be made to the treatment of the type of case of endometrial tuberculosis which I have described, namely, that in which there is no complaint other than of sterility. As the tuberculosis in these cases is usually latent or quiescent and as curettage, salpingostomy or any other surgical procedure cannot be expected to remedy the patient's complaint, it is my view that nothing is to be gained by active measures. As already indicated, several successive negative endometrial findings would appear to be necessary for a diagnosis of cure or arrest, whether spontaneous or therapeutic; and we have yet to learn whether a healed endometrium necessarily reflects healing of the tubes. Whether streptomycin or any other drug will prove of benefit only further experience can tell; but it appears to me that the problem would best be tackled along the lines of prevention of tuberculous infection in childhood and adolescence.

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DR. R. G. CROSS (Dublin)

MY excuse for speaking this morning is that I want to show some kymographic tracings. I have divided genital tuberculosis into 3 stages. In the first there are no symptoms, no palpable signs, and no complaints at all except primary

sterility. The condition is accidentally discovered during the routine examination of the endometrium. The tubes may be normal in appearance and consistency, and possess normal patency.

The second stage I describe as nodular salpingitis, which consists of little knobs of hard caseous material, the size of a pea, spaced at intervals of approximately 1 inch along the tube. This may be unilateral, with the pipe stem on the other side, or bilateral. It may be associated with a pyosalpinx on the other side.

Now I just want to show these slides as my contribution, please. The first shows chronic nodular salpingitis and I regard these appearances as typical of Stage 2 genital tuberculosis.

The next slide shows the endometrium from a doctor's wife who had no symptoms at all except primary sterility. The next shows her kymographic tracing illustrating Sharman's flattened points, which I regard as of great significance. The kymographic tracing after 3 months' treatment with streptomycin and P.A.S. shows that she is actually worse, as there is now no tubular peristalsis, which suggests that the medial layers of the tubes are now fibrosed. The endometrium, however, is free of any evidence of tuberculosis.

The last slide shows a pipe stem on the left, and chronic nodular salpingitis on the right side. If you insufflated her tubes without using a Chalmers' kymograph you would probably think her tubes were patent at 90 mm.Hg. This case illustrates the importance of the kymograph in diagnosing tuberculous salpingitis.

My other reason for addressing you is that I am very interested in genital tuberculosis as a cause of primary sterility. In spite of what anybody says, there has never been a case of pregnancy recorded in a patient whose endometrium has been proved to be tuberculous.

We are becoming confident of getting the general health of the tuberculous patient under control, and I should be grateful if those who have the facilities would concentrate on some operative procedure which would cure the sterility. I personally have had no success although bouts of amenorrhoea have from time to time raised my hopes.

DR. ERWIN RABAU (Tel Aviv)

REPORTS in the literature, together with my own experience of 13 cases, show that from 100 g. to 120 g. of streptomycin suffice to cause tuberculous changes in the endometrium to disappear. In a few cases, however, the tubercles will disappear although the inflammatory signs persist. In such cases we must rely on the bacteriological examination of the endometrium or of the menstrual discharge. If the results of these examinations are positive, further treatment with streptomycin must be carried out until culture becomes negative. Only when both histological and bacteriological examinations fail to show any evidence of tuberculosis is it justifiable to carry out investigations such as insufflation or salpingography.

This precaution is of practical importance in the treatment of those cases of sterility in which only the endometrium (and not the tubes) is involved. In our series we found the tubes to be patent in approximately 15 per cent of cases. We offer no explanation for the fact that no pregnancy occurred in these cases and we assume that tuberculosis either damages the semen or hinders nidation of the fertilized ovum.

I am now able to report the first case of pregnancy following the healing of proved (by bacterial culture) endometrial tuberculosis by streptomycin therapy. After failure to obtain any evidence of endometrial tuberculosis over a period of 1 year, the patient was submitted to a thorough curettage. At a later date her Fallopian tubes were insufflated. Six months later she became pregnant but unfortunately miscarried at the end of the third month. As no evidence of tuberculosis was found by histological examination of the endometrium removed by curettage, both before and after the miscarriage, it seems unlikely that it was caused by Koch's bacillus.

We may safely conclude that further treatment of cases of endometrial tuberculosis is permissible providing that both histological and bacteriological tests prove negative and the adnexa are not involved. This offers hope to those sterile patients whose further treatment had previously been regarded as not only impossible but also dangerous, because of the

possibility of exacerbating and extending the tuberculous disease.

Dr. A. Netter and Dr. A. Netter-Lambert (Paris)

Although secondary amenorrhoea is a common symptom of genital tuberculosis, primary amenorrhoea apart from any ovarian disturbance is a very rare manifestation of the disease.

We report the case of a patient of 22 whose somatic features were those of a sexually well developed woman. The pubic hair, breasts, and vulva were normal. The uterus was normal in size but retroflexed. The ovaries were not felt. Vaginal smears showed normal oestrogenic activity. Both the smears and the body-temperature charts indicated the occurrence of menstruation, as did the appearances of the cervical mucus. Treatment with gonadotrophic hormones and with the oestrogens failed to establish menstruation.

From the age of 4 to 7 years she had suffered from tuberculosis of the joints and there had been a recurrence of the infection when she was 11 years old. She had not suffered from peritonitis or pleurisy and no other localization of tuberculosis had occurred. Histological examination of the endometrium revealed a typical pattern of tubercular follicles with Koch's bacilli.

We conclude that tuberculosis of the uterus must be considered in all cases of amenorrhoea in which ovarian function appears to be normal.

Dr. Paul Ulrich (Paris)

There are three major therapeutic measures, which can be used either singly or combined: operation, radiotherapy, streptomycin.

Surgery

I. Operation. Up to recent times every case of genital tuberculosis was submitted to radical operation which included castration. Owing to complications with the bowel, including perforations and fistulae, the operative and postoperative mortality rate reached more than 20 per cent.

Radical primary operation may now be considered as an obsolete procedure. Surgical indications remain, however, in the following conditions:

(1) A large palpable pyosalpinx which has resisted all conservative methods, and which is associated with endless pain and discharge.

(2) Intestinal obstruction by adhesions or bands.

(3) Ascites due to peritoneal tuberculosis when the genitals are involved.

Laparotomy may be exploratory as well as therapeutic. The resulting hyperaemia favours the cure of the peritoneal tuberculous lesions.

II. *Radiotherapy.* Radiotherapy must be carried out over a wide field. Very light radiations must be administered some 3 times weekly. Heavy single doses are not desirable, because they destroy ovarian tissue and function.

X-ray therapy, either by itself or in association with conservative surgery, or streptomycin, may lead to complete cure in about 80 per cent of all cases.

Radium is advisable in isolated endometrial tuberculosis. Excision by the diathermy current is suitable for tuberculous ulcers of the vulva and vagina.

III. *Streptomycin* does not always arrest genital tuberculosis but undoubtedly favours fibrous evolution of the disease, and is an excellent preparation for conservative surgery which is thereby rendered less risky. Notwithstanding streptomycin resistance in about 20 per cent of cases, every case of genital tuberculosis should be submitted to streptomycin therapy.

In chronic cases, namely fibro-caseous abscesses, cures are less striking and operation rarely avoidable, but laparotomy seems to reactivate the waning power of streptomycin.

The dosage is 1.50 to 2 g. daily, by intramuscular injection, for a period of some 2 months. Up to 100 mg. may be injected into a fistulous track. There cannot, however, be any standard dose, as it depends essentially on the blood concentration and the renal excretion of the streptomycin. If the renal function is

impaired, blood concentration of streptomycin may be obtained with far smaller doses.

Though deserving the first place in the therapeutics of genital tuberculosis, streptomycin is not an infallible panacea. Recurrences are possible and treatment must be recommenced, as no dangerous sequelae are known to follow streptomycin therapy.

MR. LINTON SNAITH (Newcastle upon Tyne)

MY remarks will be confined to the fundamental question of how the infection arises and where genital tuberculosis fits into the general pattern of the natural history of tubercular infections.

The disease varies in its course from one individual to another, with age, sex, and other inherent factors. The various symptoms and signs which may arise can be grouped into three stages: (*a*) primary infection, (*b*) early post-primary, and (*c*) late post-primary tubercular disease.

There is, of course, a special difficulty in tracing the course of genital tuberculosis in the female, as in many cases the only symptom is infertility, and that does not become a symptom in most cases until at least 2 years after marriage.

There is fairly wide agreement on two rather important points. In the first place, the age distribution of such latent pelvic tuberculosis as may be detected, either as a result of infertility or other investigations, or in those cases in which there are overt symptoms or signs, is between 15 and 45 years. This is the period of reproductive activity, and it must be noted that early adolescence is one of the phases during which primary and early post-primary infections in general become manifest. If the primary infection is dramatic, with an allergic response, the condition is easily spotted, but there is little doubt that in many cases the primary infection produces little or no constitutional disturbance and may be entirely overlooked. The early and late post-primary stages of genital tuberculosis may, therefore, not be detected for several years.

The second important point, which is receiving considerable acceptance, is that there is some evidence that active post-primary manifestations occur, if they are to occur at all, within 3 years of the primary infection.

In the first slide I have summarized certain of the relevant points arising from a recent survey of 55 cases, all of which have been reviewed during the past 6 to 8 weeks. During the past 10 years we have encountered 130 cases of female genital tuberculosis, and are at present engaged in a complete survey of as many of these as we can still trace. Here I should mention that it is surprising how different a history one may obtain when one reviews an established case. When a woman has been told that she has pelvic tuberculosis, and has had a year or two to think about it and make inquiries, she is able to give a much more detailed and useful history of her past health, contacts, and so on.

It will be seen that there was no evident primary lesion, not at any rate enough to call the attention of the patient to it, in 21 cases, or 38 per cent, but there was a very definite primary lesion (in a few cases multiple), in 34 cases, or 62 per cent, and a history of significant exposure to the disease in 30 cases, or 55 per cent. The nature of the primary lesion was pleurisy in 29 per cent, ascites in 12.7 per cent, and gland or bone tubercle in 29 per cent of these cases. I admit that it is debatable whether one should call the latter a primary infection or not, but it may at least be said to be a primary manifestation. Erythema nodosum occurred in 5.4 per cent and this is a very important manifestation as it must indicate the allergic response to the initial infection and so gives an absolute date to that infection. Four per cent of cases gave a history of indefinite illness, which was almost certainly a response to an initial tubercular infection.

Chest X-ray was carried out in all cases, but in 10 the results were uncertain, though probably negative. The chest was negative in 28; there was a healed focus in 15 and an active lesion in 2—that is, over 31 per cent of cases showed evidence in the chest of a tubercular lesion.

The incidence of the first menstrual period is interesting. It was normal in 70 per cent and occurred at or before 15 years, although this

may be thought rather a late normal. In 30 per cent of the women, however, the first period did not occur until after 15 years, and in 19 per cent it was delayed beyond the 16th birthday. I think an incidence of nearly 20 per cent of cases in which such a delay had occurred must be regarded as significant.

In the next slide I have summarized 2 out of 7 striking case histories:

(1) Menarche occurred aet. 13; conception occurred in the following year. At the 10th week of pregnancy she suffered from a benign lymphocytic meningitis, and a shadow was detected on the lung: at the 16th week pulmonary tuberculosis was definitely diagnosed: at the 29th week premature delivery occurred associated with antepartum haemorrhage: at the 8th week postpartum a tubal mass on the left side was detected and biopsy revealed tuberculosis both of the endometrium and of the cervix.

(2) Patient aet. 22; menarche normal; developed erythema nodosum 3 years later, while in close contact with a case of active pulmonary tuberculosis. A year later tuberculous peritonitis was diagnosed, although the lungs had remained unaffected. Four years later she was found at the infertility clinic to have endometrial tuberculosis, but her lungs were still clear.

I will conclude with these observations. I think there is evidence to suggest that genital tuberculosis, whether latent or active, should be regarded as one of the earliest post-primary infections, usually occurring within 3 years of effective exposure to the disease. In some cases, but in by no means all, there is an obvious primary lesion as a result of such exposure and the disease presumably spreads through the blood-stream to the pelvis. The genital tract escapes injury if the primary infection occurs when it is still immature, and establishes some resistance against later tubercular infection. If, however, the primary infection occurs later, at a time when the reproductive organs are becoming active, infection of the genital tract is more likely, probably because both events occur when the girl enters upon the world at large, where tuberculosis is less adequately controlled than it is in the schools.

Miss M. Moore White (London)

After making a brief reference to the literature concerning the radiographic appearances of tuberculous Fallopian tubes, Miss Moore White showed kymographic tracings and salpingograms from cases subsequently proved to be tuberculous.

The kymographs depicted:

(1) Non-patency.
(2) Patency at high pressure with no peristalsis.
(3) Patency with infrequent waves and rounded peaks.
(4) Patency at low pressure with no peristalsis.
(5) False patency.

The salpingograms depicted:

(1) Cornual occlusion.
(2) Terminal occlusion with small terminal dilatations.
(3) Terminal occlusion with large flask-like dilatations and mottling.
(4) Long straight tubes with or without small filling defects.
(5) Calcification in the line of the tubes often mistaken for poor filling.
(6) A jagged outline and fluffiness alongside the tubes.
(7) Beading and variations in density of filling.
(8) Coiling of the tube.
(9) Venous and tissue intravasation.

In 6 of the above forms depicted by the salpingogram, a diagnosis of tuberculosis should be possible.

Mr. Stallworthy (*Reply*)

As one who at the beginning asked for information, I would like to thank the many who have taught us so much. Professor ten Berge referred to the dangers of lipiodol and most of us are agreed that the watery soluble medium is safer. Dr. Sutherland referred to the very interesting examples of apparently primary cervical infection and it is possible that the incidence of primary infection of the cervix is much higher than has previously been recognized.

I was asked " What do you do in a case of genital tuberculosis in association with an active primary lesion in the lung? " The answer is that only twice since the advent of streptomycin have we resorted to surgery in the treatment of genital tuberculosis. I do want to emphasize that point, lest some of you should think that we have been advocating radical surgery. Dr. Sutherland gave details of the routine for diagnosis and the criteria of cure, and I would like to subscribe to those, as do all of those who are at present working under the aegis of the Research Committee to which he referred. In the series that has been presented we have accepted the diagnosis of genital tuberculosis when it is confirmed bacteriologically. Now for those people who are trying to estimate the value of the various lines of treatment it would seem to be an essential basic fact that bacteriological diagnosis, both of the original infection and of cure, should be made.

I am grateful, as I am sure you are, to Dr. Cross and Miss Moore White for their references to the kymograph and for the X-ray pictures they showed. I am sure, too, that you would all like to join with me in congratulating Dr. Rabau whose patient became pregnant after being treated for proved endometrial tuberculosis. That is the first authentic case recorded in the literature. Dr. Cross referred to plastic operations on tuberculous tubes, but I personally would be frightened to operate on tubes in which active infection has been diagnosed. I did admire Miss Moore White's pictures, as I have admired all the work she has published on the subject of fertility. She stated that certain appearances were diagnostic of tuberculosis of the tube and I am sure she is right in most cases. There are, however, fallacies, because I have found that endometriosis can give a similar picture.

Dr. Netter spoke of secondary amenorrhoea as being a common manifestation of tuberculosis. That is not the experience of workers in this country. Dr. Netter asked a very pertinent question and it was " What do you do when you have a young patient with apparently isolated uterine infection? " We would now treat these people with streptomycin and P.A.S., and it may be that soon we will add the nicotinic acid derivatives.

The evidence available at present suggests that these derivatives are more bacteriostatic than bacteriocidal and if that is correct they will need to be used with other antibiotics. Be that as it may, we treat these people at present on conservative lines and would operate only if there was clinical evidence of a spread of infection.

Finally, sir, I would summarize by saying that all active tuberculosis of the pelvis is serious and the absence of physical signs does not make the prognosis better; that a correct pre-operative diagnosis can be made in most cases; that surgery should be avoided except under the conditions laid down; that if an operation is carried out it should be carefully planned, both in timing and extent; and that all new drugs should be carefully controlled before they are widely used. The time is premature for dogma and another review will be necessary in the next 5 or 10 years.

SUMMARY OF THE CONGRESS

THE first British Congress of Obstetrics and Gynaecology was held in London in 1920, and the thirteenth in Leeds from the 8th to the 11th of July, 1952. Three hundred and forty-one members attended the Congress, of whom 117 came from 23 different foreign countries. Members came from all over the world, from both the Americas, from many European countries, from India, Pakistan, and Ceylon, and indeed from all the countries of the British Commonwealth of Nations. The largest delegation, numbering 35, came from France, but no fewer than 23 came from the United States of America.

Professor M. A. van Bouwdijk Bastiaanse, Head of the Department of Obstetrics and Gynaecology in the University of Amsterdam, read the guest paper on "Carcinoma of the Body of the Uterus". Dr. Albert H. Aldridge the Chief Surgeon to the Women's Hospital, New York, was the other guest speaker and opened the discussion on "Stress Incontinence of Urine".

Certain innovations, some of necessity and others by way of experiment, were tried at Leeds. In the first place, the Local Congress Committee was formed on a regional basis and included representatives not only from Leeds but also from Bradford, Halifax, Harrogate, and Huddersfield.

In the second place, Harrogate was used as a dormitory while the scientific meetings were held in Leeds. Such an arrangement possesses manifest advantages and disadvantages, but demands elaborate organization. Arrangements had to be made for members to register either in Harrogate or in Leeds, but it was not possible to know beforehand who would register where. A fleet of buses conveyed members from Harrogate to Leeds and this complicated arrangement worked very smoothly and ensured the punctual arrival of the great majority of those who attended the meetings.

It is tempting to speculate whether in the not-far-distant future Congresses will be held at some accessible watering place which could provide adequate accommodation. Very little organization would then be required and the Congress could be held annually if it was thought desirable. The individuality and variation which characterizes each Congress would, of course, be lost and its character would inevitably become static.

The third and perhaps most important innovation was the decision of the Journal Committee to devote a whole number of the *Journal of Obstetrics and Gynaecology of the British Empire* to the publication of the Transactions of the Congress. It is to be hoped that this arrangement will be made permanent.

The experimental innovations were: (1) the devotion of a whole day to an obstetrical and another to a gynaecological subject; (2) having only a morning session on the second day, thus allowing members to be free in the afternoon, but necessitating a sixth session on the Friday morning; (3) a break of 10 minutes in the middle of the morning session, as smoking was not permitted in the Riley Smith Hall.

It is too early to assess opinion about these changes, but it can be said that only four members who wanted to take part in the discussions failed to do so, and all four were debarred on the last morning.

THE SCIENTIFIC MEETINGS

The scientific meetings were held in the Riley Smith Hall which proved to be eminently suitable for the purpose. Other rooms in the Students' Union building were used for the registration of members; for an exhibition of medical instruments, products and books; and for a pathological display arranged by Dr. Lissimore. Some 20 medical students, both ladies and gentlemen, volunteered to act as stewards. Some acted both in Harrogate and in Leeds and shepherded members in to the buses and helped

them in numerous ways. Others acted as doorkeepers, and still others were in charge of the curtains which darkened the Riley Smith Hall. It is no exaggeration to say that the smooth running of the Congress owed much to their efficient co-operation.

Other Congress Activities

Dame Hilda Lloyd in opening the Congress pointed out that one of the most important features of such gatherings was the opportunity they afforded for meeting friends, for the exchange of ideas, and for social intercourse, and these aspects were not forgotten. On Tuesday evening members were invited by the Lord Mayor of Leeds, Alderman Burnley, and the President of the North of England Obstetrical and Gynaecological Society, Mr. Percy Malpas, to a Civic Reception at Temple Newsam Mansion, in which Darnley, husband of Mary Queen of Scots, was born. The guests were received by the Lord Mayor and Lady Mayoress of Leeds and by Mr. and Mrs. Malpas. They were then conducted round the mansion and afterwards assembled for refreshments most generously provided by the North of England Obstetrical and Gynaecological Society. The Lord Mayor in welcoming the guests expressed his pleasure that the Congress was being held in Leeds, and Mr. Malpas replied.

On Wednesday afternoon Her Royal Highness the Princess Royal, Chancellor of the University of Leeds, conferred the Honorary Degree of Doctor of Laws on Professor Bastiaanse, Dr. Aldridge, and Sir Eardley Holland. They were presented by Professor Claye, and Sir Eardley Holland replied. On the same evening Leeds University invited members of the Congress and their ladies to a reception at the Parkinson Building and they were received by Her Royal Highness, the Chancellor. The dignity, splendour and colour of this occasion, heightened by the scarlet academic robes; the pageantry of the degree ceremony; and the fact that Her Royal Highness the Chancellor so graciously consented to attend both ceremonies, made Wednesday memorable.

The Banquet was held on Thursday evening at the Majestic Hotel, Harrogate, and 350 members and ladies sat down to dinner. The guests included Dame Hilda Lloyd, Professor and Mrs. Bastiaanse, Dr. and Mrs. Aldridge, The Mayor and Mayoress of Harrogate, the Right Reverend the Lord Bishop of Ripon, the Recorder of Leeds and Mrs. Hinchcliffe, the Vice-Chancellor of Leeds University and Mrs. Morris, Sir George and Lady Martin, and the Editor of the *Yorkshire Post* and Mrs. Andrews.

The Ladies Committee

The Ladies Committee arranged and conducted half-day excursions to Fountains Abbey, Haworth, Harewood House, the Lister Mills, and a whole day's visit to York. The arduous work put in by this Committee was made the more difficult by the fact that some member or members were on duty all day and every day, both at the Prospect Hotel, Harrogate, and in the Committee Room in the Students' Union Building at Leeds. Their efficiency is best illustrated by the following true story. A European lady called in one morning and said that she wanted to visit an up-to-date farm and buy a bull-calf to take back with her. This was arranged without any fuss within 5 minutes, although it has not yet been reported how the calf travelled. The social success of the Congress was largely due to the untiring efforts of the ladies of this Committee.

Conclusion

The weather remained fine and this in no little measure contributed to the enjoyment of the social functions. The papers and discussions maintained a high level and there can be little doubt that many of the views expressed will be reflected in gynaecological teaching throughout the country. The proceedings were electrically recorded by Messrs. Leeds Thermionic Products.

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Postscript by the Editor. The assembling and preparation of the material for the report of the Congress was in the hands of the Honorary Editor, Mr. G. W. Theobald who was assisted by Mr. E. Gledhill. The Editor of the Journal is deeply grateful to Mr. Theobald for the care and promptness with which these duties were carried out.

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